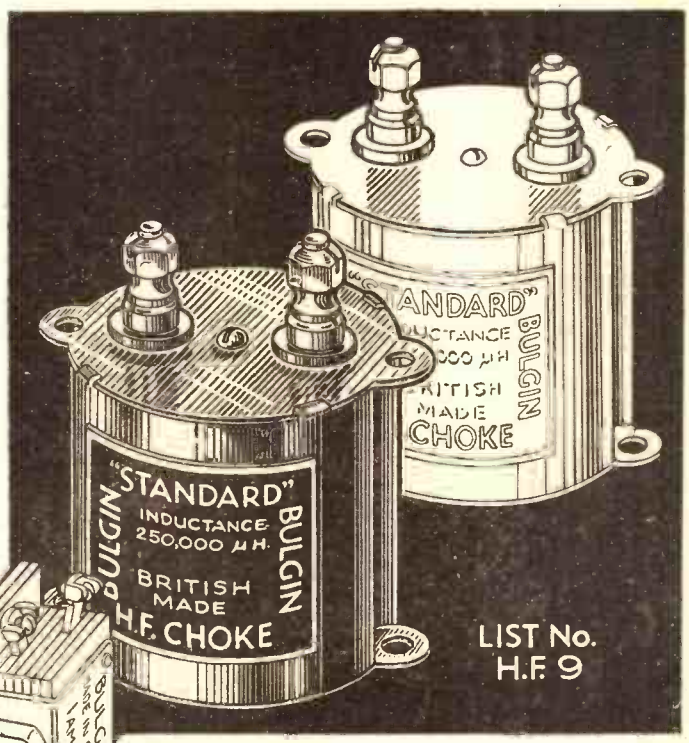
H.F. CHOKES & SWITCHES

for the "BIFOCAL 3"

AN ENTIRELY NEW CONCEPTION OF THREE-VALVE DESIGN

The Set which Constructors have been waiting for, and which embodies not only the finest specialised components of leading manufacturers, but revolutionary principles of control.

BULGIN H.F. CHOKES AND SWITCHES, being of marked originality and design, are an essential link in the chain of selected components.



LIST No. H.F. 9

Technical Details of

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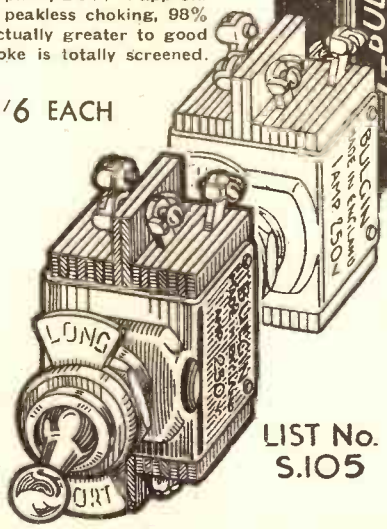
Fully screened in frosted-aluminium-finished universal-mounting cases fitted with locked terminals. Self-inductance = 250,000 μH. Self-capacity 2·5 μμF. approx. D.C. resistance = 400 Ω. Smooth peakless choking, 98% approx. for 200-1,800 m. (Range actually greater to good percentage.) Note: This H.F. Choke is totally screened.

LIST No. H.F.9, 3/6 EACH



LIST No. S.105

Technical Details of

SPECIFIED WAVE-CHANGE SWITCHES.

Fully-insulated snap toggle-action double-pole two-way switches. Complete with LONG/SHORT indicating plate. Nickel-plated metal parts and laminated insulation. Contact resistance, under 0·01 Ω. Insulation resistance, over 50 M Ω. Terminal connections.

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Large stocks are available for immediate delivery, and with the specified components we guarantee the results as claimed.

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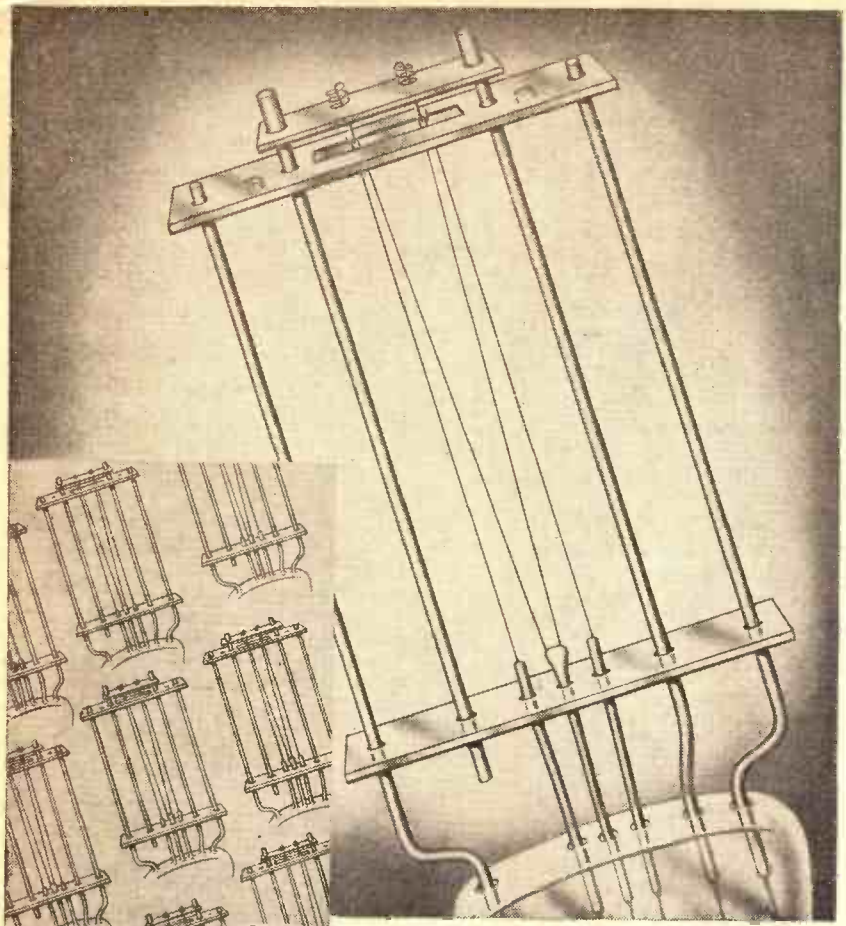

One of the most important considerations in valve manufacture is securing and maintaining accuracy and uniformity of characteristics.

In Cossor Valves, filament diameter is accurate to within *one ten thousandth of an inch*—a degree of accuracy used ordinarily only in the laboratory. Yet, so careful are Cossor engineers to ensure this vital uniformity of characteristics that they apply laboratory principles in the factory. Every individual Cossor Valve must be *exact.* And they see that it is.

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VALVE FILAMENTS
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Get one of the new Cossor Station Charts which gives the revised wavelengths, etc., of over 80 foreign stations and has space for entering your own dial readings, price 2d. from your Dealer or write to A. C. Cossor Ltd., Melody Dept., Highbury Grove, London, N.5, enclosing 2d. stamp.

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POPULAR WIRELESS
THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

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Technical Editor: G. V. DOWDING, Associate I.E.E.
Assistant Editor: P. ROBERT BIRD.
Managing Editor: N. F. EDWARDS.
Chief Radio Consultant: P. P. ECKERSLEY.
Assistant Editor: A JOHNSON-RANDALL.
Chief of Research: K. D. ROGERS.

BETTER TELEGRAPHY
CROONING NOTES
SHORT-WAVERS DINE
THE MIDDLE AGES

RADIO NOTES & NEWS

MEASURING NOISE
SOCIETY PLUMS
RADIO PLAY CRITICS
MORE TELEVISION

Progress in the U.S.A.

THE Radio Corporation of America announces that it has developed a means of transmitting three different radio telegrams simultaneously on one wavelength. Three distinct sets of Morse signals are interlaced and then separated into three separate messages at the receiving end.

Each of the three communication channels has a capacity of sixty words a minute, so that the total capacity of the one wavelength is 180 words per minute. This is a great step forward, in view of the congestion of the ether. But how on earth is it done?

Photo Transmission on Short Waves.

ANOTHER development which the R.C.A. proposes to introduce in a photogram service between New York and Philadelphia is one for transmitting pictures and messages by the facsimile process on waves of less than five metres in length.

Clients may hand in photographs, plans, or typewritten messages, and exact facsimiles of these will be delivered to the addressees, the tariffs being based on a charge per square inch.

This service is expected to open late this year, and will be, so far as I know, the first of its kind to operate on "optical" waves—that is, waves which have properties closely analogous to those of light.

Views on "Crooners."

VERY little has appeared in these notes about "crooners," but as those gentry now bulk so large in contemporary radio journalism—here goes.

With all due respect for their "ear for music" and their skill in singing, I think that "crooners" should be abolished—from dance bands—and found some more appropriate environment in which to express themselves.

They are as out of place in a dance band as Dame Ethel Smyth would be in the "Kentucky Minstrels." That's all.

A Notable International Event.

THE International Short-Wave Club is to hold its first annual dinner and dance on Thursday, March 22nd, at Maison Lyons, Shaftesbury Avenue, London, W.1. Tickets are six shillings each, and "P.W." readers (and especially their ladies) are invited. The guests of honour will be the American Consul-General and certain broadcasting officials.

Applications for tickets should be addressed to Mr. A. E. Bear, 10, St. Mary's Place, Rotherhithe, London, S.E.16. I wish all who attend the best of good times.

Real Old English?

IF Chaucer spoke English, then the Advisory Committee on spoken English should take steps to study the dialect of the Black Country, for it is said that there one may hear almost pure Chaucerian English. In order to account for this vestige of old England Mr. Joe Deeley, the dialect entertainer, suggests that the true Black Country lies in a bowl which is overlooked by the ruins of Dudley Castle.

SELECTIVITY?—

The answer is on page 1063, et seq.

The "BIFOCAL THREE" — the greatest event of the year in home-constructor radio, is the Industry's answer to the New Wavelength Plan.

It has been designed by nine of Great Britain's leading component manufacturers, and *you* as a home-constructor and as a reader of "P.W." are provided, as usual, with the first and exclusive opportunity of enjoying the result of such a combination of brilliance!

BE WISE —"BIFOCALISE"!

For in the words of the designers, this is THE SET THAT MAKES THE NEW WAVELENGTH PLAN PRACTICABLE!

In the Middle Ages the castle wore an aspect which discouraged visits from strangers; and in later days the steep sides of the bowl—Mucklow Hill, Gorsty Hill, etc.—deterred travellers in horse-drawn vehicles.

Attenuated Answers.

T. M. (Guildford).—I *know!* But lots of folk *are* interested in the broadcast band—and "P.W." will never desert them. K. L. (Dumfries).—The probable zone of origin of "atmospherics"—*of some kinds*—can be determined by apparatus such as that by which a ship's position is found.

"Fan" (Chelsea).—That there are "fans" in Chelsea! I never suspected it! Well, the Americans are clever electricians, but not better than ours here. But when they do something big they announce it loudly. I don't blame them, but that's the answer.

The Problem of Interference.

IN the matter of the problem of eliminating electrical interference with radio reception, progress can be reported. Twenty-eight public, scientific and commercial bodies have pooled their knowledge, and investigations carried out "on the spot" have enabled the committee already to reach definite conclusions as to the manner of dealing with interference by trolly buses, lifts, ignition systems and certain minor causes of trouble.

Good Out of Evil.

ONE advantage, besides the elimination of interference, has accrued to radio as a result of these investigations. The committee asked the National Physical Laboratory, the Electrical Research Association and some individual scientists to produce an instrument for the measurement of the ratio of electrical noise to signal strength.

Such an apparatus has been devised, and input signal strength can now be compared exactly with output strength, and thus radio has gained a new scientific means of testing the efficiency of receivers.

Join a Progressive Radio Society.

AS a hint to radio society committees, and in order to show readers what a good society can provide, I give a brief résumé of the spring programme of the Exeter and District Wireless Society, whose President is Sir Ambrose Fleming:

"The Heaviside Layer"; Demonstration of cathode-ray television; "Radio Receivers for 1934"; Demonstration of the latest short-wave receivers; "Radio Servicing: Causes, Cures and Suggestions"; "Rectification: a New Theory"; "Television Developments and the Amateur"; "Static: Its Causes and Neutralisation."

(*Continued on next page.*)

TAKING THEIR MINDS OFF THE METER

I have picked at random from the pie—and they are all plums, don't you think? Hon. Sec.: W. J. Ching, 9, Sivell Place, Heavitree.

New York Taxi Radio Returns.

EIGHTEEN days after the New York taximen were told to remove the radio sets from their vehicles the new Police Commissioner reversed the order.

Subject to certain provisos, he ruled that the radio did not cause street accidents or annoy passengers.

Therefore it is probable that such sets must in future be installed so as to be solely within the control of the passenger, and unusable when the engine is not running or the car is parked. I can understand the driver's anxiety to have radio aboard. It takes the fare's mind off the meter.

More Brief Replies.

DEXER (Lincoln).—You've got it all wrong, sweet chuck. Nobody invented short waves, not even Marconi or an American, though, naturally, the Chinese had them 4,000 years ago.

P. F. G. (Acton).—What would I do if my wife hated radio? I think I should try to find out what she liked, give it to her and go on with my radio. Fair's fair!

T. S. (Frome).—If I saw a *pink* deposit on my battery's plates I should try to say, "Truly rural." If successful I should ask the charging station to use white amperes in future.

The Art of Radio Criticism.

PERMIT me to take exception to a certain style of criticism which is rife, especially in reviews of radio plays. Considering the rigorous limitations under which the producers and players labour, I submit that it is a matter for congratulation that the most successful radio plays are as good as they are.

The fact is that, as broadcasting is a new art, its critics ought to approach it from a new angle—not as though they have just come from a theatre. It is difficult to criticise without some sort of standard—and what standards have yet been agreed for broadcast plays?

Radio Players to Learn Parts.

MEANWHILE, what is being done to develop the art of play broadcasting?

The best improvement which has come to my notice is that which has been put into force by the U.S.A. National Broadcasting Company, who now expect the players to speak their parts from memory.

The "ribbon" microphone allows the speakers freedom of movement in the studio, and the belief is that their performances will be vastly improved if they play up to one another instead of playing down to the script.

Medium Wave DX.

THOUGH this subject has been fairly well ventilated, I am going to refer to a letter from W. S. (Chesterfield), a new reader, because his pleasure in his results is so intense yet so unaffectedly expressed. He got several U.S.A. stations at his first attempt (290, 360 and 440 metres, roughly), but does not give their call-letters.

However, it appears that some of the items received so entranced him that he forgot that he was supposed to be searching. When the B.B.C. can make foreigners do *that* it may buy a bigger hat. D. P., of the same town, writes to say that he got confirmation from WTIC, 283 metres. Meet Mr. W. S.!

India and the "Pirates."

A COMMON-SENSE step towards the prevention of radio "piracy" was taken in India on January 1st, on and from which date no purchaser of a set may complete the transaction without showing a valid licence to the dealer.

Further, the dealers have to keep a register of their sales of receivers, to be inspected on the demand of the appropriate officials. The dealers themselves must possess licences.

Ohio's New College.

AS an example of how radio is used in America, consider Ohio's new junior radio college, which has recently begun working from Ohio State University. Over 2,000 students are enrolled already, for courses in English, French, Spanish and social sciences.

When the students enrol later for residence courses at the university they may obtain university credit for their radio work by passing examinations in the courses which they have taken. The professors who teach over the radio give their services free.

A Television Demonstration.

ON February 7th Cossor's gave a demonstration of a new cathode-ray television system before a meeting of the Institution of Electrical Engineers, when "cinema" films were reproduced.

It is claimed that the variable-speed scanning which the system employs gives better detail and brighter pictures and abolishes the problems of synchronisation.

Unfortunately, I could not attend the meeting; otherwise I could have given you personal opinions of the demonstration. But matters in the television department are certainly moving.

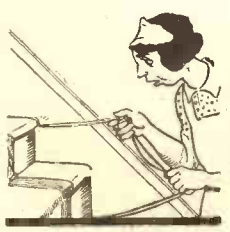
The Joke that Failed.

FROM the Buenos Aires "Revista Telegrafica Radio"—a first-class journal indeed—I purvey to you this story: Nine years ago. Buenos Aires amateurs trying to get long distances. Some sprightly jokers rigged up locally a tiny transmitter, with which they imitated the wavelength, "fading," announcers (helped by a friendly American) and programmes of a well-known American station.

The result was that the amateurs could scarcely believe their ears, though they boasted all the same. Then some kid, listening on his crystal set, *heard North America, too*, and the bottom fell out of the joke.

A Domestic Tragedy.

NOW she *has* done it! "Gasper Gert" has wilfully torn up the wires which connect the radio set to the L.S. extension in our dining-room; all pure zeal for our service, too.



Probably actuated by a conscience which was stimulated by a "rise" last week, she evidently made a closer examination of the condition of the stairs leading from my study, where the set lives, to the floor on which we have the dining-room.

There she discovered my wires, cunningly hidden; and from thence she ravished them. "These here strings," she told my wife, "must have been left by the last people!" Oh, Gertrude!

More Haste, Less Aerial.

AND this reminds me of the sad tale of my brother. He is one of those bloated capitalists who has everything about his house done by someone else.

Well, one night his signals and aerial simply disappeared, and morning light revealed that the local wireless expert, instead of fastening the aerial to a hook in the outside of the wall, had passed the wire through the window of a half-forgotten box-room to a hook in some wretched "linerusta"—which had at last given way.

My brother said that his household had noted how draughty the house had been since the new aerial had been put up. Of course, the window could not be properly closed because of the wire.

ARIEL.

BRIGHTER MOMENTS

MORE TO HER TASTE.

Smith: "Is your wife fond of listening-in?"
Jones: "No, she prefers speaking out."
"The Humorist."

LESSON IN TACT.

We learn that the members of a slimming class in South London do exercises to the music of the wireless. The instructress, however, is careful never to hurt the feelings of sensitive new pupils by switching on the fat-stock prices.

QUICK THINKING.

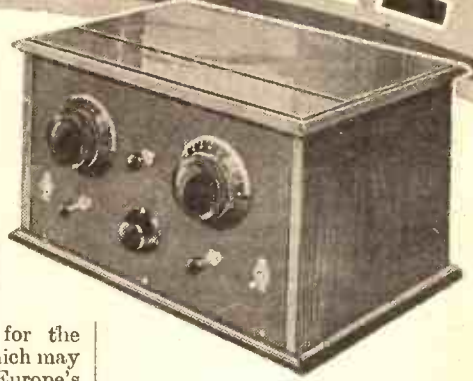
Mistress (pointing to cobweb in corner): "Mary, have you seen this?"
Mary: "Oh yes, mum. I think it's something to do with the wireless."

HEARD, BUT NOT SEEN.

A magistrate tells us that some people receive threatening letters practically every day. That, of course, is one of the disadvantages of being a wireless lecturer.

The BIFOCAL THREE

DESIGNED & PRESENTED BY LEADING MANUFACTURERS OF THE RADIO INDUSTRY



INTRODUCING A GREAT NEW PRINCIPLE

IT is with very great pleasure that we are able this week to present exclusively to "P.W." readers the first details of an entirely new and revolutionary development which is destined to have far-reaching consequences in the world of home-constructor radio.

Cleaning up the Chaos.

It is obvious to most of us by now that the ultimate solution of the chaotic conditions which exist in the ether to-day is not a matter for the broadcasting authorities alone, and that if distant, and in fact, in some cases, home listening in the future is to be of any real value as a source of trouble-free entertainment, our aims in regard to receiver design generally must all be towards overcoming the difficulties which have arisen in consequence of the first two months' operation of the Lucerne Plan.

Lucerne has done much, but consideration of the magnitude of the task makes it more and more apparent that a wholesale thinning out of existing inefficient receivers will unfortunately be necessary for the success of this or any future plan which may emerge from the deliberations of Europe's broadcasting authorities.

The Answer to the Lucerne Plan.

The guiding light of "P.W.'s" policy has always been to place the interests of its readers above all else. As the growth of broadcasting has brought us face to face with new problems, so have we endeavoured to overcome those problems—not by the easy way out of exhorting you to build new receivers every time, but by offering practical and inexpensive suggestions for the adaptation of existing designs.

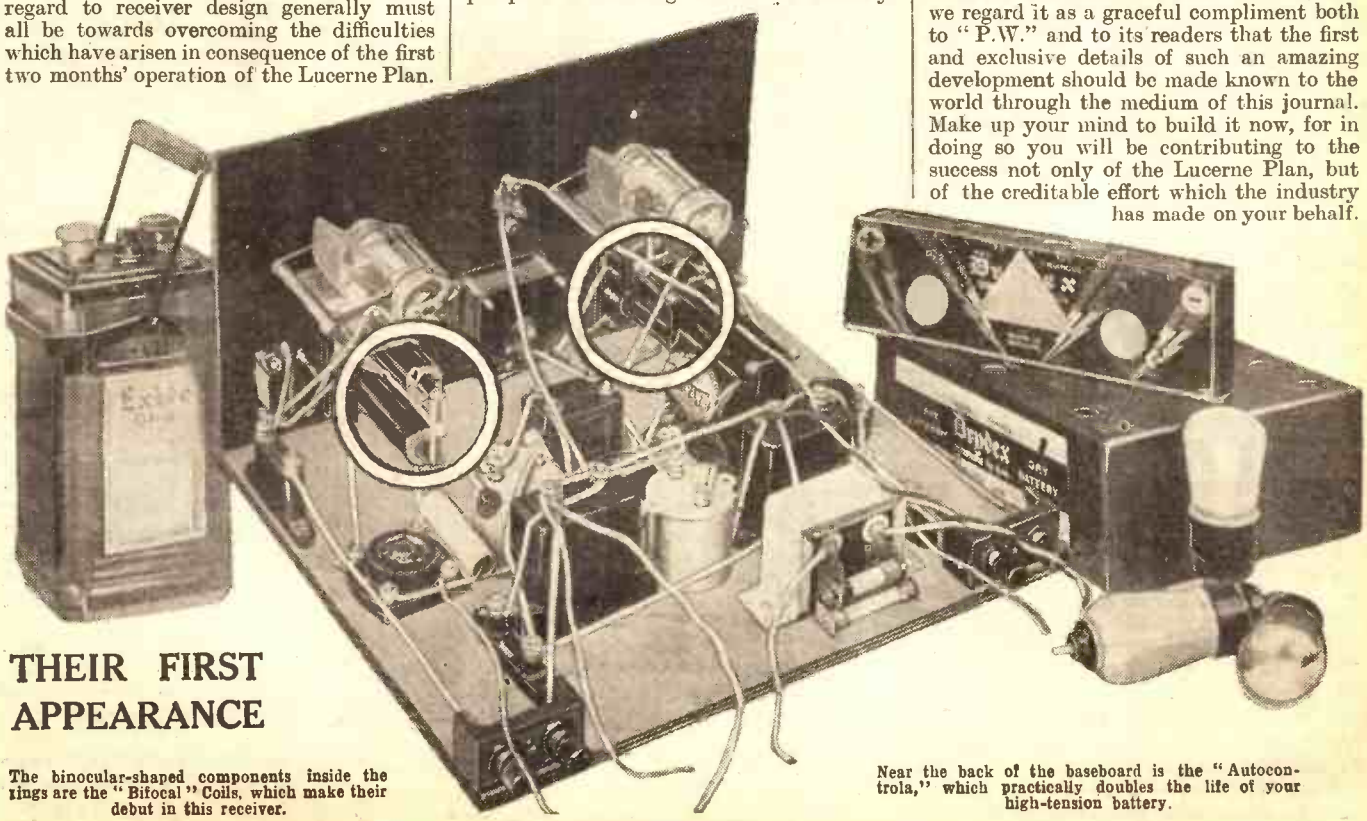
But now we are faced with the fact that palliatives are no longer adequate. The stringent requirements of a receiver for modern conditions call for something more than temporary measures, and if you would keep pace with the times you *must* face the prospect of building a new set entirely.

Free with this issue of "P.W." is a blue print constructional chart of a set that makes radio history—a set that has been designed and which is presented by a group of Great Britain's leading component manufacturers representative of the radio industry. What finer advice could we offer other than that you should make *this* your set of the future?

The "Bifocal Three," with its remarkable new principle of "focused" radio, is the radio industry's answer to the New Wavelength Plan. It is the most momentous development for years, and after our own practical tests we are happy to endorse all the claims that are made for it.

Truly an Amazing Development.

Frankly, we know of no set more suited to meet the new conditions than this one, and we regard it as a graceful compliment both to "P.W." and to its readers that the first and exclusive details of such an amazing development should be made known to the world through the medium of this journal. Make up your mind to build it now, for in doing so you will be contributing to the success not only of the Lucerne Plan, but of the creditable effort which the industry has made on your behalf.



THEIR FIRST APPEARANCE

The binocular-shaped components inside the rings are the "Bifocal" Coils, which make their debut in this receiver.

Near the back of the baseboard is the "Autocontrola," which practically doubles the life of your high-tension battery.

The INDUSTRY'S ANSWER to the CHAOS IN THE ETHER

THE Radio Industry on Parade! No greater team of experts, no finer combination of technical resources and manufacturing skill has before been concerted on the production of one single design. The "Bifocal Three," the most outstanding home-constructor event of the year, is indeed the industry's answer to chaos in the ether. And what an answer!

You have only to realise the greatness of the names associated with it to appreciate the tremendously important part that this set is destined to play in the future of home-constructor radio. Varley, Ferranti, Benjamin, J.B., Bulgin, Westinghouse, Dubilier, T.C.C. and Belling & Lee: names in the radio sense that are indeed household words, names that have helped to build the industry from insignificance to might; names that are representative of the finest technical brains in the country.

And *you*, as a home constructor and as a reader of "P.W.," are provided with the first and exclusive opportunity of enjoying the result of such a combination of brilliance. That you will take full advantage of this unique opportunity we take as a matter for granted, and for that reason we do not propose at this juncture to eulogise about the merits of the set.

A Sterling Pedigree.

But you may rest assured that any set with such a sterling pedigree as this one possesses is destined to be a winner from the start, and the sooner you decide to build one for yourself the sooner will you be enabled to enjoy all the advantages of radio as it should be enjoyed.

At the invitation of the Editor of 'P.W." some of the leading characters in the evolution of this meritorious design have sent enthusiastic messages to all potential constructors of the "Bifocal Three." It is with pleasure that we are able herewith to record their impressions as conveyed in interviews with a "P.W." representative.

The first interview was with Mr. J. M. G. Rees, the go-ahead director of Varley.

"Well," said Mr. Rees," if you really want to know what I think of this set, I regard it as a tremendous step forward towards the long-sought-after ideal of interference-free radio."

HOW THE WHEEL OF PROGRESS BROUGHT YOU THE "BIFOCAL THREE"

"The time has come when most existing standards of sensitivity and selectivity are inadequate for modern conditions," continued Mr. Rees. "And I am more than happy to be associated with a design that provides such a ready and efficient way out.

"Any of your readers who are experiencing selectivity troubles would be well advised to make the 'Bifocal Three,' for it is my firm belief that the astonishing principle of focused radio on which it is based sets a standard that is more than in keeping with the exacting requirements of modern conditions."

The Development of the Coil.

Before leaving the head office of Varley, our representative was able to have a few words with Mr. K. Higginson, who has been intimately concerned with the technical development of the "Bifocal" coil.

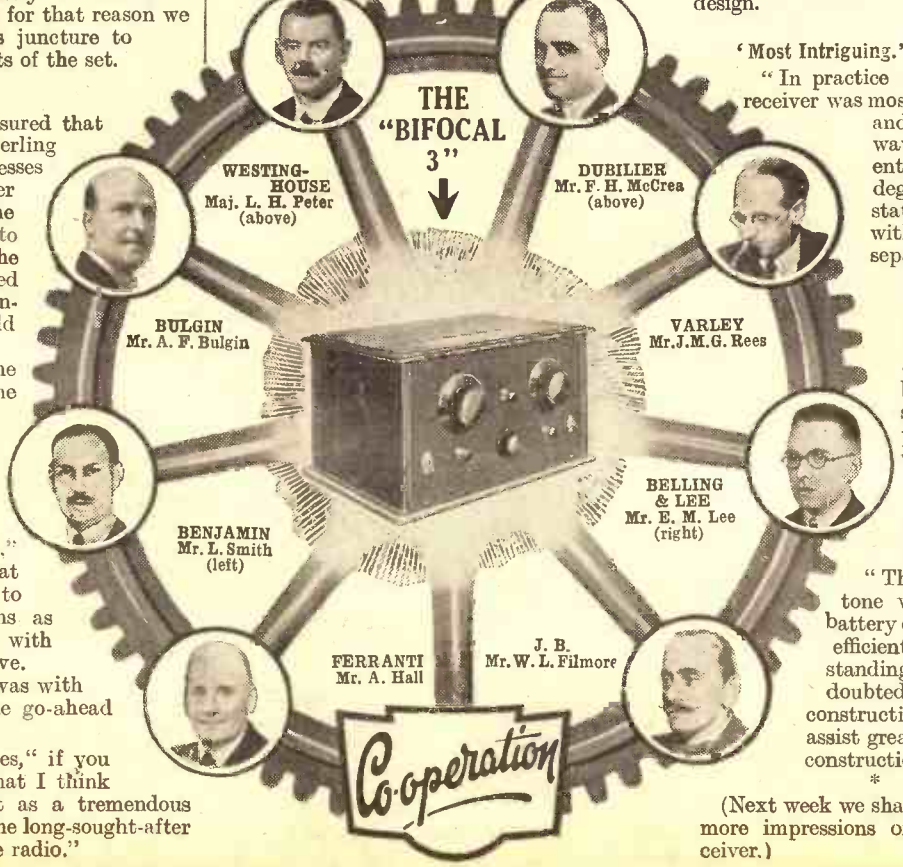
Mr. Higginson was full of optimism about the future of this great new principle.

"I think you will agree," he said, "that whilst an enormous amount of work has been done during the past few years in radio technique, one of the simplest and most important features has been rather neglected owing to the great difficulties besetting the problem.

"It was the ingenious combination of air-cored and iron-cored high-frequency technique that made the solution possible, and I congratulate you on so quickly appreciating the possibilities of this system, and so promptly giving your readers the undoubted benefit of such advantages."

Mr. A. F. Bulgin, the Governing Director of A. F. Bulgin & Co., Ltd., had some very enthusiastic comments to make concerning the "Bifocal Three."

"I can definitely say," said Mr. Bulgin, "that the 'Bifocal Three' is the best three-valve set I have yet heard, and I consider the results to be a very fine achievement in design.


THE "BIFOCAL 3"
WESTING-HOUSE Maj. L. H. Peter (above)
DUBILIER Mr. F. H. McCrea (above)
BULGIN Mr. A. F. Bulgin
VARLEY Mr. J. M. G. Rees
BELLING & LEE Mr. E. M. Lee (right)
BENJAMIN Mr. L. Smith (left)
FERRANTI Mr. A. Hall
J. B. Mr. W. L. Filmore
Co-operation

'Most Intriguing.'

"In practice the 'Bifocal Three' receiver was most intriguing to handle, and the results on both wavebands were consistently good to a high degree. Any two adjacent stations which interfered with each other could be separated quite easily by the adjustment of the coil cores. It was quite evident that this introduced a very great degree of selectivity, but, and this I consider an important point, no loss of volume was sustained and it was evident that the effect on sidebands was negligible.

"The response and general tone was excellent, and the battery economiser circuit most efficient in use. This fine outstanding receiver will undoubtedly revolutionise home-construction design, and will assist greatly in keeping home construction well to the fore."

* * *

(Next week we shall be able to give some more impressions of this remarkable receiver.)

PROGRESS!

SOME NOTES ON—

The EVOLUTION of SELECTIVITY

IT is, unfortunately, a fact that at no time in the history of European broadcasting has the need for highly selective circuits been greater than it is to-day. Consideration of the problem of an ever-increasing number of stations in wavebands, of which the extremities are fixed, makes it pretty plain that the eventual solution does not rest with the broadcasting authorities alone, and that if we are to overcome the present formidable prospect of perpetual ether chaos we have simply got to do something about it on the receiving side.

The Need Becomes Obvious.

Perhaps it would be more to the point to say that we have got to do something *further* about it on the receiving side, for everybody must be aware that the progress of receiver design has, in many ways, more than kept pace with the rapid growth of broadcasting. It is only now, after the first few weeks' operation of the Lucerne Plan, that the need for still more selective circuits becomes obvious.

But it is easy to have an ideal. To reach that ideal is another matter altogether; and even when the objective is reached it does not necessarily mean the end of heterodyne interference, for that is very largely a question for the broadcasting stations themselves.

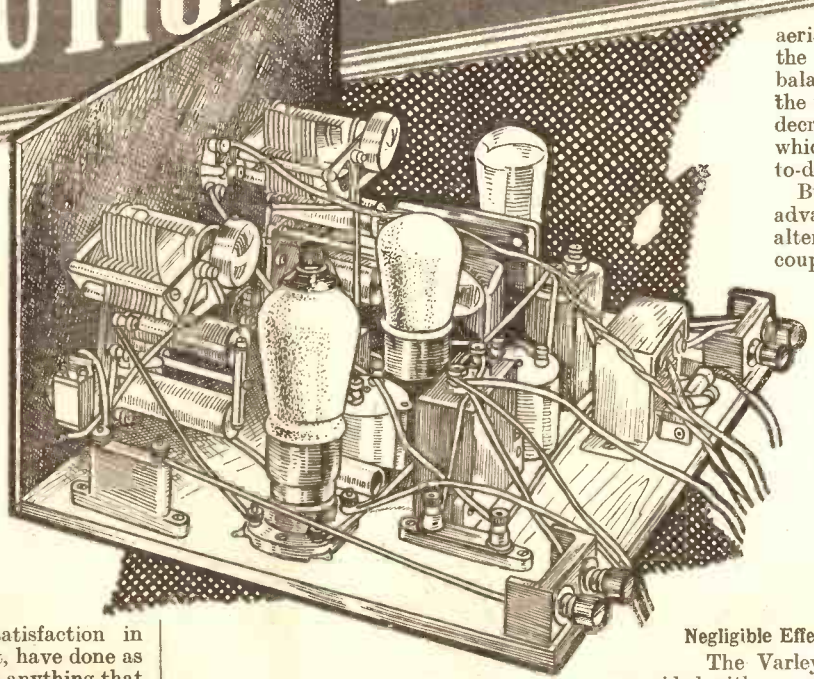
Uudoubtedly a Great Step Forward.

But there is at least satisfaction in knowing that we, on our part, have done as much as we possibly can, and anything that helps us towards that ideal can justifiably be hailed as a great development. That is why we are unstinting in our praise of the new principle of focused radio. Considered from the point of view of all those hundreds of thousands of readers who, for financial or other reasons, must needs be content with more or less straightforward three- or four-valve receivers, focused radio is undoubtedly a great step forward.

It is a great step forward for many reasons.

In the majority of two-tuned-circuit receivers commonly in use to-day, and assuming, of course, an average-size aerial, the only satisfactory way of obtaining a reasonable measure of selectivity is by a reduction in the degree of aerial coupling. That can be achieved in three ways: (a) by the straightforward method of tapping the aerial down the grid coil; (b) by the use of a separate aerial winding; or (c) by connecting a small fixed or semi-variable condenser directly in series with the aerial. Sometimes it is necessary to combine methods (a) and (c) or (b) and (c) in order to achieve the desired results. But none of the schemes is perfect.

The advance in the attainment of easily-achieved selectivity control is a fascinating story of technical progress. Step by step the increasing obstacles had to be overcome, and below we tell how the final victory against higher power and more stations was won by the discovery of an entirely new principle—"bifocal" tuning.



If the degree of aerial coupling is fixed, then it is unfortunately a fact that the sensitivity of the set can only reach maximum on one particular wavelength. While it is true that the efficiency of the set on waves below the optimum may be only slightly reduced, as the wavelength is *increased* beyond the point of maximum sensitivity it is common to find a gradual but quite noticeable decrease in signal strength, and stations working between 450 and 550 metres are rarely so good as those between, say, 200 and 300 metres.

A Compromise is Necessary.

The only way to improve the efficiency of the set on the higher-wave stations—i.e. between 450 and 550 metres—is by an increase in aerial coupling, but that adversely affects the performance at the lower end of the scale, and tuning becomes flat and unselective. Thus, with existing methods, it is necessary to arrive at a compromise whereby selectivity is adequate for the lower-wave stations and sensitivity good enough for the higher-wave stations.

Solving the Problem.

But that is not all. The question of reaction also enters into it, for if, in an endeavour to improve selectivity, the degree of aerial coupling is reduced, the "damping" across the circuit is correspondingly reduced, and with some sets it may be found that the set will not stop oscillating even with the reaction condenser at minimum.

A solution to the problem might appear to be in the use of some sort of variable aerial-coupling device so that the sensitivity/selectivity balance could be adjusted as the wavelength is increased or decreased, and that is a scheme which is commonly in use to-day.

But it has the great disadvantage that whenever you alter the degree of aerial coupling you also alter the tuning of the set, and that upsets calibration. If the coupling could be varied by means of some sort of infinitely variable tapping which did *not* affect tuning or reaction, then obviously the scheme would be ideal.

That is precisely what has been achieved with the new Varley "Bifocal" coil, and that is why it represents such a very great step forward.

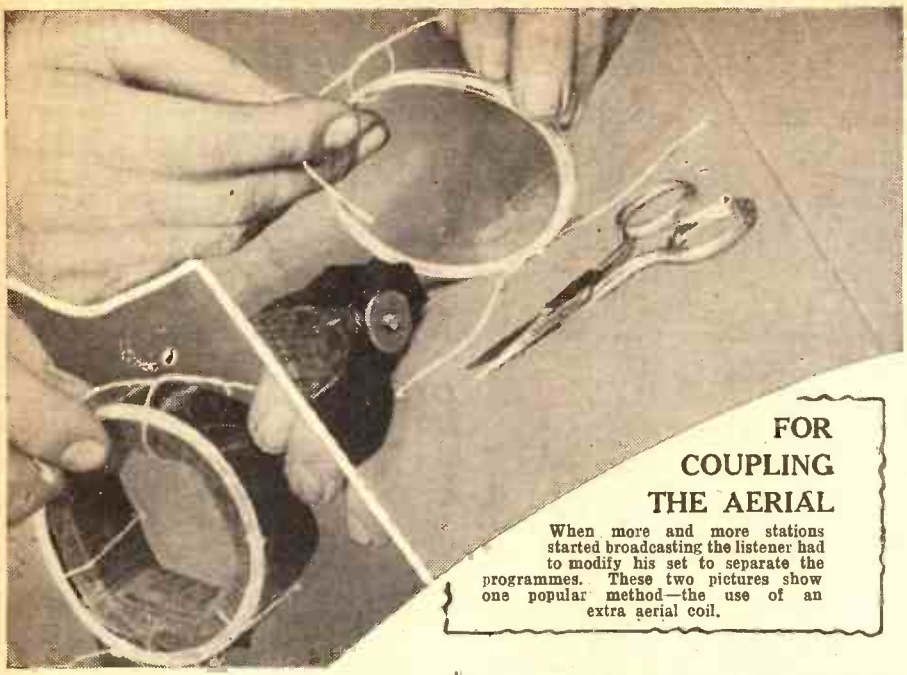
Negligible Effects on Tuning.

The Varley "Bifocal" coil is provided with a small iron core the position of which, in relation to the windings by which it is surrounded, can be varied within certain limits by the plunger, which projects through the front of the panel.

After months of experiment in the disposition of the actual windings, a stage has been reached whereby the movement within certain limits of this iron core does not affect the overall inductance of the coil. Consequently, with this coil it is possible to obtain an aerial coupling ratio of from 1·4 : 1 to 8 : 1 *with only a negligible effect upon tuning and reaction.*

What actually happens is that, although the total inductance of the coil remains virtually constant, variation of the position

(*Continued on next page.*)



FOR COUPLING THE AERIAL

When more and more stations started broadcasting the listener had to modify his set to separate the programmes. These two pictures show one popular method—the use of an extra aerial coil.

(*Continued from previous page.*)

of the iron core has the effect of altering the *ratio* of inductance between the earthed end of the coil and the aerial tap, and the aerial tap and the grid end of the coil. Thus the degree of coupling is varied without actually altering the tap and without appreciably affecting the overall inductance of the coil.

In other words, taking the case of a set with a fixed aerial tapping, instead of having to be content with a compromise giving optimum results on only one particular wavelength and the inevitable falling off in efficiency towards the top end of the dial, it is now possible to obtain optimum results, within reason, on every station that you hear! As you tune in a station, so you focus it for best results just in the same way that you focus a pair of binoculars to bring some distant object into view.

None of the Usual Disadvantages.

It will be immediately apparent that this is indeed a very great step forward when viewed in relation to existing methods, for it has all the advantages of constantly variable aerial coupling, with none of the usual disadvantages. It means to say that when you have actually tuned in a station you can in effect vary the aerial-tapping position for best results on that particular station without it upsetting the tuning. The same remarks apply to reaction.

But the advantages of the focusing system do not end there. With a set employing a fixed aerial tapping the degree of selectivity at any given part of the tuning scale is also fixed, which means to say that if, with this particular aerial tapping, the set is not sufficiently selective to separate two stations—well, they just have to remain *un*separated, unless you are prepared to alter the tap, which will also alter the tuning and probably lose the stations altogether!

You Clear Away the Interference

Not so the "Bifocal." If, when you have tuned in a station, there is another one causing interference in the background, the operation of focusing will enable you in most cases to clear away the interference without the slightest risk in doing so of losing the station to which the set is tuned. That is something you cannot do with any existing method. Hence the reason why focused radio is destined to play such an important part in the future of home-constructor designs. It is an ideal that has been sought after for years, and only now, at a time, appropriately enough, when ether congestion is at its worst, has it materialised.

Up to now we have been concerned with the aspect of selectivity only in so far as it affects the first tuned circuit in the set. Precisely the same reasoning holds good for the intervalve circuit, and with the combination of two "Bifocal" coils in the one set the circuit holds out amazing possibilities. The sensitivity/selectivity balance can be varied to suit every station on both medium and long waves, and the operation of focusing is so very simple that one can rightly claim that this much-sought-after ideal has been achieved without added complication—another very strong point in its favour.

In the case of the intervalve "Bifocal" focusing coil, the position of the tapping on the grid coil controls the amount of amplified H.F. that is "let through," so to speak, from the anode circuit of the S.G. valve. Again, if the tapping is fixed, optimum results can only be obtained on one particular wavelength.

An Infinitely Variable Device.

But the use of what is, to all intents and purposes, an infinitely variable "letting through" device ensures maximum sensitivity, consistent with the degree of selectivity required for adequate separation, on *all* wavebands.

It may be said of the "Bifocal Three" that in general it is better to operate the two focusing controls together. But that should not be accepted as a hard and fast rule, for there have been occasions in the course of our many tests when the separate operation of the two controls has brought about better results. While it is true that maximum sensitivity on any given station is obtained when the two focusing controls are "matched," the selectivity requirements for complete separation may necessitate the re-adjustment of one or other of the controls independently. But it is marvellous, anyway, to feel that you can at last do that to order!

THE SEARCH FOR SELECTIVITY

Another popular means of sharpening the tuning was to use an X-type coil, as shown in the picture to the right.

Instead of X-coils some listeners preferred home-wound coils, as shown below.

These early methods of obtaining a modicum of selectivity now give way to the new system of focused tuning.

What you need When Building The BIFOCAL THREE

(1)...2 VARLEY "BIFOCAL" FOCUSING COILS. The "Bifocal Three" is the first receiver ever to be designed incorporating these remarkable coils. The price of the coils is 10s. 6d. each, and there is every reason to believe that there will be a tremendous demand for them. Arrangements have been made for adequate supplies to be delivered all over the country by the time this issue is published; but if you should experience any difficulty in obtaining them, please communicate direct with Messrs. Varley, 103, Kingsway, London, W.C.2.

(2)...2 J.B. ·0005-MFD. "POPULAR LOG" SLOW-MOTION TUNING CONDENSERS. J.B.'s famous "Popular Logs" are components that are universally obtainable. They have been chosen for use in this set because the precision with which they are manufactured ensures absolute reliability. The retail price is 7s. 6d. each complete.

(3)...1 BENJAMIN PUSH-PULL ON-OFF SWITCH WITH TERMINALS. Good contacts are vitally necessary for a switch in the L.T. circuit. This Benjamin 9d. line could not be beaten at the price.

(4)...2 BULGIN WAVECHANGE SWITCHES, TYPE S105. The name of Bulgin is a household word where switches are concerned, and type S105 was found to be ideal for wavechanging in the "Bifocal" design. It costs 3s.

(5)...1 J.B. ·0003 MFD. DIFFERENTIAL REACTION CONDENSER. The use of reaction in the design is to ensure maximum sensitivity. Do not defeat its object by using an inferior component in this position. The J.B. "diff." has been thoroughly tried and tested, and is consistent in its performance. The price of 4s. 6d. is very moderate.

(6)...1 PANEL MEASURING 12IN. BY 7 IN. Discarded motor tyres make good panels—to look at! Use only a branded panel or one that is guaranteed, and you will not go very far wrong. This size of ebonite in a reputable make should not cost more than 2s. 6d.

(7)...1 FERRANTI TYPE A.F.4 L.F. TRANSFORMER. The L.F. transformer can make or mar any set. In the present case the superb quality of reproduction that is given by the "Bifocal Three" is largely due to the use of this remarkably efficient transformer. Don't experiment; it costs more in the long run, and the famous A.F.4 is worth much more than the 17s.6d. that is charged for it.

(8)...2 DUBILIER ·0002-MFD. FIXED CONDENSERS, TYPE 620. Dependability is the keynote of all Dubilier products, hence the reason why these condensers are to be found in the design of the "Bifocal." Price 1s. 3d. each.

(9)...1 S.G. ANODE CONNECTOR. This tiny refinement is optional. It does not affect the performance of the set in any way, but it facilitates the provision of a good contact, and it is a useful safety device against the possibility of short circuit.

(10)...1 T.C.C. ·0001-MFD. FIXED CONDENSER, TYPE 34. "Green for safety," the famous slogan of the Telegraph Condenser Company, was never more appropriate than in the case of the "Bifocal" design. This condenser will cost you 1s. 3d.

(11)...2 BENJAMIN 4-PIN VALVE HOLDERS. These are the popular Benjamin "Vibrolder" type holders. Firm contact is everything in a valve holder, and these particular ones have stood the test of time. 10d. each is the price.

(11A)...1 BENJAMIN 5-PIN VALVE HOLDER. This is to accommodate the pentode output valve. It is not of the "Vibrolder" type, but it is very satisfactory in use. It is the same price as the 4-pin.

(12)...1 DUBILIER 2-MEGOHM RESISTANCE. This is of the 1-watt type, and it is provided with wire ends. It will cost you 1s.

(13)...2 BULGIN SCREENED STANDARD H.F. 9 CHOKES. The high standard of efficiency that is demanded of the chokes in the "Bifocal" design calls for only the best. These popular Bulgin chokes conform absolutely with the specification laid down by the designers, and they have the additional merit of being inexpensive. They cost only 3s. 6d. each.

(14)...1 T.C.C. ·1-MFD. TUBULAR FIXED CONDENSER, TYPE 250. This condenser is fitted with wire ends, thus contributing towards the simplicity of construction. The retail price is 1s. 4d.

(15)...1 T.C.C. 2-MFD. FIXED CONDENSER, TYPE 50. The 3s. 6d. which you will have to put down for this condenser is money well spent, for you can at least be assured of absolute reliability with T.C.C. products.

(15A)...1 DUBILIER 2-MFD. FIXED CONDENSER, TYPE BB. The popular Dubilier type BB 2-mfd. fixed condenser is another component that costs 3s. 6d., but it is one of those components that is made to last a lifetime.

(16)...1 FERRANTI NEW TYPE 5,000-OHM RESISTANCE. This is one of a new range of resistances that has just been produced by Ferranti to sell at 1s. each. The "Bifocal Three" is the first set to use it.

(17)...1 BENJAMIN "AUTOCONTROLA" UNIT. Designed to bring about a drastic reduction in your H.T. running costs. This entirely new Benjamin unit is another component that makes its debut in the "Bifocal Three." The price is 7s. 6d.

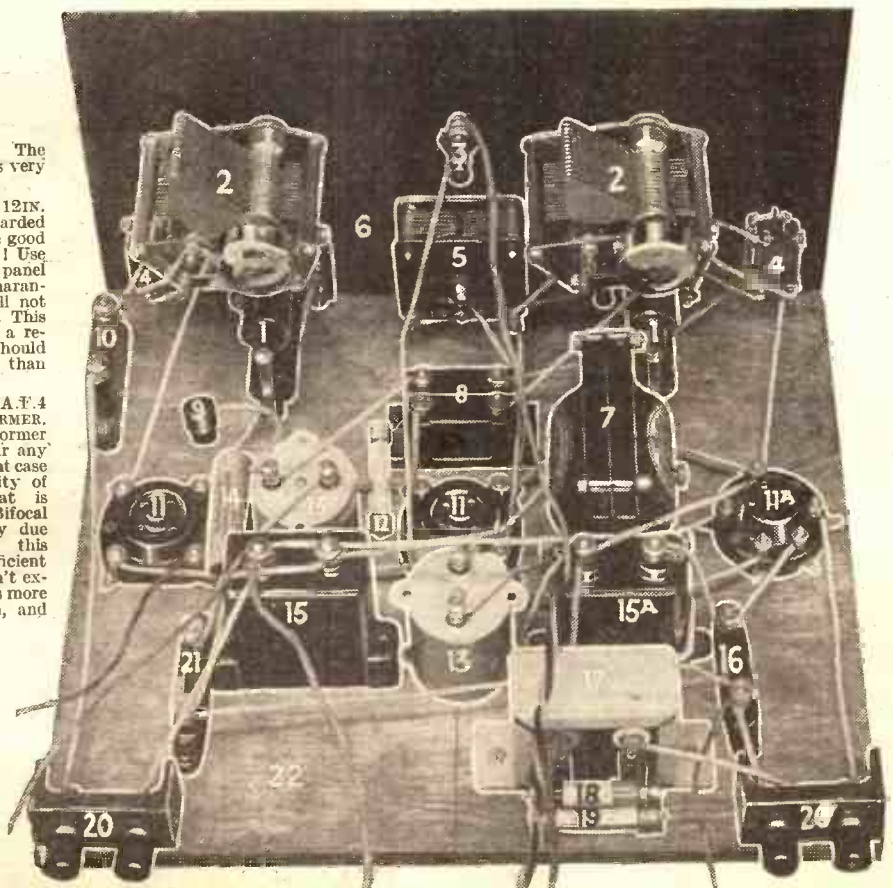
(18)...1 WESTINGHOUSE "WESTECTOR" TYPE W.6. This is for use in the Benjamin "Autocontrola" Unit. It goes into the top pair of clips on the actual unit, and it will cost you 7s. 6d.

(19)...1 DUBILIER 100,000-OHM 1-WATT TYPE RESISTANCE. The wire ends with which this resistance is supplied should be cut off before it is inserted between the bottom pair of clips on the "Autocontrola" unit. The price of this resistance is 1s.

(20)...2 BELLING-LEE TERMINAL MOUNTS AND 4 ENGRAVED TYPE R TERMINALS. The engravings on the four terminals required are "A," "E," "L.S.+" and "L.S.−." The terminal mounts, complete with terminals, cost 2s.

(21)...1 FERRANTI NEW TYPE 50,000-OHM RESISTANCE. Price 1s. The same remarks apply to this component as to No. 16.

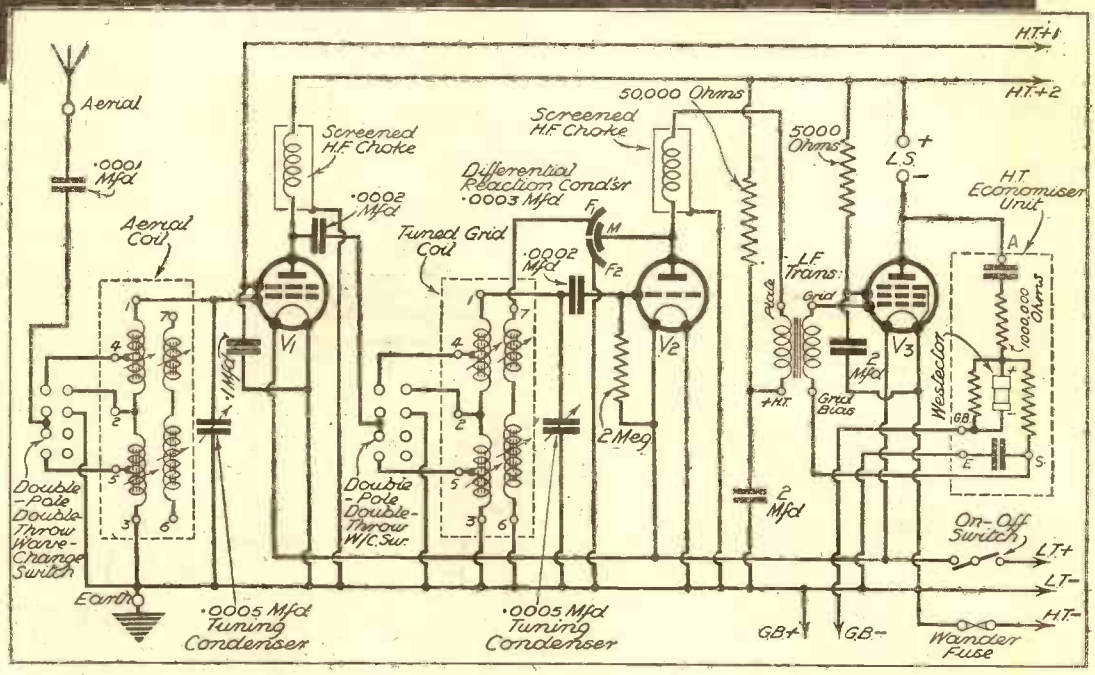
(22)...1 PLYWOOD BASEBOARD. The dimensions of the baseboard are 12 in. by 10 in. by ¾in. See that the edges are square, particularly the one to which the panel will ultimately be fixed. The probable cost is 1s. 3d.



NOTE.—For your convenience and guidance when building the set the positions of all the components listed on this page are indicated by the key numbers on the photograph.

The VITAL POINTS in THEORY

BRIEF NOTES ON THE MERITS OF THE BIFOCAL 3 DESIGN



RECENTLY published statistics show that the S.G.-det.-L.F. combination of three valves is the one most universally in use to-day. There are many reasons for this. It is a combination that is easy to build, it is economical in use, it is in most cases simple to operate and up to now it has answered perfectly the requirements of those listeners who are concerned only with first-class quality reception of the local stations with a reasonable number of reliable alternatives.

But so acute has the wavelength position become of late that the set of yesterday is no longer equal to the task imposed upon it, and but for the timely arrival of the "focused radio" principle of reception there is little doubt that the popularity of the "three" would by this time have been on the wane.

Focused radio has definitely saved the situation, and now, far from there being a falling off in the popularity of the "three," there is every reason to believe that it will have an even greater number of adherents.

The theoretical conception of the "Bifocal Three," with its new feature of focused radio, is interesting inasmuch as it is in many respects such a radical departure from known systems. It represents the perfection of an ideal that has been sought after by technicians for years, and it could not have materialised at a more opportune moment, for just at present increased selectivity *without* loss of efficiency is the concern of all.

A Revolutionary Principle.

So that you may get a better idea of the working of the focusing principle—the principle which may eventually revolutionise receiver design—it might, perhaps, be more helpful to regard it in terms of an analogy, although, strictly speaking, there is no figurative way that really does justice to the importance of the development.

First, a word or two about general principles. The secret of the success of the new "Bifocal" coil is that with it a way has at last been found of varying in effect the degree of aerial coupling *without* upsetting the L/C. ratio of the tuned circuit. In other words, the total inductance of the coil in the grid circuit remains virtually constant with aerial coupling that is to all intents and purposes infinitely variable.

Perfect Balance for All Stations.

With every existing scheme, variation of aerial coupling even between narrow limits has an effect upon the total inductance of the coil, and the result is that it is not possible to make any alteration to the degree of aerial coupling without fear of it upsetting the tuning. With the "Bifocal" coil the sensitivity/selectivity balance of the set can be adjusted for best results on *every* station without any of the attendant disadvantages.

You will, perhaps, be better able to understand it by likening it to an ordinary motor-car engine which, although it may be assumed for the purposes of this analogy to have a fixed number of revolutions a minute, can be made to drive the car fast or slow by the use of different gear ratios. The number of revolutions—in other words, the total inductance of the coil—remains unaffected, despite any alterations which may be made to the driving ratio: in this case the aerial coupling. If you so arrange the aerial coupling to give you greater power, then automatically you will get less selectivity, just in the same way that if, with the petrol engine, you use a lower gear to get greater power, you automatically get less speed. But the number of revolutions per minute of the engine proper remains constant, just in the same way that the total inductance of the "Bifocal" coil remains constant.

It would be no exaggeration to say that the invention of focused radio ranks in importance with the invention of the gear box in motoring. It provides a variable ratio of "power," the importance of which cannot be too strongly emphasised.

The design of the S.G. stage in the "Bifocal Three" is, of course, based upon these new coils. As will be seen from the circuit diagram, there is one in the grid circuit of the S.G. valve which provides for constantly variable regulation of the aerial input, and a second one is connected between the S.G. valve and the detector valve as an intervalve coupling unit. The use of two of these coils in this fashion opens up endless possibilities, and provides for standards of selectivity and sensitivity hitherto unattainable from only one H.F. stage.

As will be readily appreciated, with coils of such high efficiency a considerable amount of care has been necessary in the design of the associated circuits to ensure that no losses shall be introduced. Both the tuning condensers and the wavechange switches that are used in the "Bifocal Three" are of a type in which the losses are negligible.

It will be seen that a pentode valve is used in the output position, which, although very nice from the point of view of power, is apt in the ordinary way to increase running expenses.

H.T. Costs Cut Right Down.

But you need have no fears on these grounds with the "Bifocal" design, for by the inclusion of a new and ingenious unit known as the Benjamin "Autocontrola," the H.T. running costs may be cut down, in some cases by as much as half.

Summed up, the theoretical conception of the "Bifocal Three" will leave no doubt in the minds of those who are technically inclined as to the tremendous advantages that this great new development offers. It is the set of to-morrow here to-day!

BIFOCAL TUNING

ALL ABOUT THE SET'S OPERATION

Sheer simplicity of working is one of the greatest features of this new design, and just how easy the operation is will be evident from this detailed description of the whole process.

THERE will be many who will imagine that the term "focused radio" is just a convenient way of expressing an idea that is, in actual fact, rather away from the usually understood meaning of the word.

Ordinarily, when we talk about focusing in the light sense, we mean the regulation of the distance between the eye or lens and the object in order to produce a clear image. When we talk about focusing a pair of binoculars, for instance, we mean the adjustment of the lenses to bring some distant object sharply and clearly into view; in other words, the attainment of definition of something which ordinarily to the naked eye might be blurred and indistinct.

An Entirely New Principle.

That is precisely the function of the focusing controls in the "Bifocal Three" except, of course, that in this case it is a question of sound and not vision. But fundamentally the idea is the same, and if you bear that closely in mind you will find it a great help when it comes to operating your version of the set.

Focused radio is an entirely new principle, and for that very reason it may have the effect of frightening many who might otherwise be keen to combat the difficulties which have been forced upon us by the European wavelength situation. It need not. In practice the operation of focusing is as fascinating as it is effective, and far from complicating matters it should make *successful* operation very much easier.

Robbed of all its technicalities and reduced to terms of everyday language, having tuned in a station, in the process of focusing you endeavour to do to it exactly what you would do to a distant object through a pair of binoculars. In other words, you endeavour to make the transmission clear and sharply defined.

Practise for an Evening or Two.

If, for instance, the transmission happens to be marred by the "monkey-chatter" of an interfering station, as all too frequently happens these days, it will, in many cases, be found possible to "clean it up" by careful adjustment of the focusing controls. We say "in many cases" advisedly, for whatever the merits of this great new principle it must be remembered that it cannot work miracles. If two stations are heterodyned through the failure of one or both of them rigidly to adhere to their allotted wavelengths, then not even the most selective of superhets can put right what is wrong at the source.

But, generally speaking, it will be found possible with the "Bifocal Three" to wipe out a lot of the troubles which tend at the moment to make distant listening a farce.

It may require an evening or two of practice before you are able to enjoy to the full all the advantages that the scheme has to offer, but right from the moment when you switch on for the first time the merits of the invention will be obvious.

But perhaps we are rather tending to encourage you to run before you can walk, so to speak. Before you can begin to experience the joys of focused radio there are certain aspects of installation and adjustment with which you will be concerned, and time spent on explaining these points will not be wasted.

The question of valves and appropriate voltages is adequately covered in the constructional brochure which is presented with this issue of "P.W.," but there are two other points in connection with accessories to which it is desirable to call attention. First the loudspeaker requirements of the set.

To receive a station on the "Bifocal Three" clear of interference, the first operation—tuning—is carried out exactly as for an ordinary two-dial receiver.

It is, fortunately, a fact that any reputable speaker will give entirely satisfactory results in conjunction with the "Bifocal Three," but undoubtedly the most desirable type is a reasonably sensitive permanent-magnet moving-coil instrument. Practically all branded speakers of this type are equipped with an output transformer these days, but it is important to note that the speaker chosen must be of the type suitable for use in conjunction with a pentode output valve.

A Very Straightforward Proposition.

If you use a speaker of the W.B. "Microlode" type it becomes a very straightforward proposition, for this speaker has a switch incorporated enabling it to be matched-up to any output arrangement.

The second point is in connection with tone correction. In certain circumstances the use of a pentode valve in the output stage tends, if anything, to accentuate high notes. Some people like it; others are not so keen; but in any case it is easily cured if you feel that your reproduction is a little too brilliant.

All that the set requires is a ·01-mfd. fixed condenser joined in series with a 15,000-ohm resistance across the loudspeaker terminals. The value of the resistance is not critical, and although 15,000 ohms is about the average value required it is quite a good scheme to try other values near it if you happen to have them by you.

With a mains set this refinement is in many cases necessary, but with a battery type pentode the accentuation is not nearly so great, and it is purely a matter for individual opinion as to whether or not the high notes are slightly overdone.

The actual operation of the "Bifocal

(*Continued on next page.*)

BIFOCAL TUNING

(*Continued from previous page.*)

Three " is very similar, in a general sense, to that of any other straightforward S.G.-det.-L.F. three-valver, except, of course, that you can do with this set what you *cannot* do with any other set of similar circuit sequence.

Assuming that your set is connected up and ready for use, the recommended procedure is as follows:

First see that the knobs of your wave-change switches are pointing in the same direction—that is to say, both up for long waves or both down for medium waves. Set the focusing controls about half-way in, and starting from zero, slowly rotate both of the tuning condensers together until you hear one or other of the local stations.

Adjusting the Controls.

For this first test it is doubtful whether you will find it necessary to use any reaction, and the reaction condenser can therefore be left at zero, which is the position as far as it will go in an anti-clockwise direction.

Now to find a distant station. Leave the focusing controls where they are for the time being and advance reaction, not to the point where the set breaks into oscillation, but just below it. Next slowly rotate the two main tuning controls, taking particular care to see that you keep them "in step."

This "in-step" business may sound rather complicated, but it is really very simple.

Keeping the Circuits in Step.

When the two circuits, or, if you like, the two tuning condensers, are in step you will notice that the set has a certain liveliness about it which is not present otherwise. It does not necessarily follow, by the way, that the condensers are in step when the two dial readings are identical. They should be somewhere about the same at any given point of the tuning range, but for the circuits to be in step the dial readings at any given instant may vary by five or, in extreme cases, even by ten degrees.

THE VALVES

V_1 (S.G.)	Cossor 220 S.G.
V_2 (Det.)	Cossor 210 H.F.
V_3 (Pentode)	Cossor 220 P.T.

BATTERIES

L.T. (2 volts)	Exide, type D.M.G.
H.T. (120 volts)	Exide, type H.1074
G.B. (16½ volts)	Exide, type H. 1002

But the way to tell whether the circuits are in step is not by the dial readings. The most reliable way is to listen for that condition of liveliness to which we have referred, and if you aim at maintaining that condition as you operate the two dials you will not go very far wrong.

Not At All Difficult.

In practice it is very easy, for the simple reason that the moment you hear a station it is possible to tell instantly whether the circuits are in step. When you locate a particular transmission that you want to hear, and *before* you touch the focusing controls, just gently "rock" each of the tuning condensers in turn until you hear the station at its loudest.

Now for the fun of focusing! Take hold of one focusing control in each hand and, in moving them both together, try to move them at the same relative speeds. The operation should, in any case, be done *very* gently, and the direction

(*Continued on page* 1095.)

THE PRINCIPAL BROADCASTING STATIONS, THEIR WAVELENGTHS & POWER EMPLOYED

Name of Station	Wave-length (metres)	Power (kilo-watts)
Aberdeen	233·5	1
Algiers	318·8	12
Athlone	531	60
Barcelona	293·5	3
Bari	283·3	20
Belfast	267·4	1
Belgrade	437·3	2·5
Berlin	356·7	100
Beromunster	539·6	60
Bordeaux	278·6	12
Bournemouth	203·5	1
Bratislava	298·8	13·5
Brasov	1,875	20
Breslau	315·8	60
Brno	325·4	32
Brussels I	483·9	15
Brussels II	321·9	15
Bucharest	364·5	12
Budapest I	549·5	120
Copenhagen	255·1	10
Cork	241·1	1
Danzig	230·2	·5
Daventry 5XX	1,500	30
Dublin	222·6	1
Florence	491·8	20
Frankfurt-am-Main	251	17
Geneva	748	1·3
Genoa	304·3	10
Gleiwitz	243·7	5
Gomel	312·8	1·2
Goteborg	318·8	10
Graz	338·6	7
Grenoble	309·9	20
Hamar	578	·7
Hamburg	331·9	100
Heilsberg	291	60
Helsinki	335·2	10
Hilversum	301·5	20
Horby	265·3	10
Huizen	1,845	7
Innsbruck	578	·5
Kalundborg	1,261	75
Katowice	395·8	12
Kaunas	1,935	7
Kharkov I	1,345	20
Kharkov II	253·2	10
Kiev	415·5	100
Klagenfurt	209·9	·5
Konigsberg	222·6	·5
Konigswusterhausen	1,571	60
Kosice	269·5	2·6
Lahti	1,796	40
Langenberg	455·9	60
Leipzig	382·2	120
Leningrad I	1,224	100
Lille	247·3	5
Limoges	328·6	·5
Linz	231·8	·5
Ljubljana	569·3	5
Lodz	222·6	1·7
London National	261·1	50
London Regional	342·1	50
Luxembourg	1,304	150
Lwow	377·4	16
Lyons	463	15
Madrid	274	7
Magyarovar	208·6	1·25
Marseilles	400·5	5
Midland Regional	391·1	25
Milan I	368·6	50
Minsk	1,442	100
Miskolc	208·6	1·25
Monte Ceneri	257·1	15
Moravska-Ostrava	259·1	11·2
Moscow I	1,714	500
Moscow II	1,107	100
Motala	1,389	30
Muhlacker (Stuttgart)	522·6	100
Munich	405·4	100
Naples	271·7	1·5
Newcastle	209·9	1
North National	296·2	50
North Regional	449·1	50
Oslo	1,186	60
Palermo	531	3
Paris (Ecole Superieure)	431·7	7
Paris (Poste Parisien)	312·8	100
Plymouth	203·5	·3
Poznan	345·6	1·7
Prague I	470·2	120
Radio Paris	1,796	75
Rennes	288·5	2·5
Reykjavik	1,639	16
Riga	514·6	15
Rome I.	420·8	50
Salzburg	231·8	·5
San Sebastian	238·5	3
Scottish National	285·7	50
Scottish Regional	373·1	50
Sottens	443·1	25
Stockholm	428·1	55
Strasbourg	349·2	12
Sundsvall	499·2	10
Tallinn	410·4	20
Tiraspol	280·9	10
Toulouse	386·6	2
Trieste	245·5	10
Trondhjem	476·9	1·2
Turin	263·2	7
Vienna	506·8	120
Warsaw I	1,415	120
West National	261·1	50
West Regional	307·1	50
Wilno	559·7	16
Zagreb	276·2	·7

—AND THE BATTERIES

exclusively recommended for the "BIFOCAL 3" are, *of course,*

Exide AND Drydex

For L.T.—Exide, DMG, 2 volts, 70 ampere hours **11/-**

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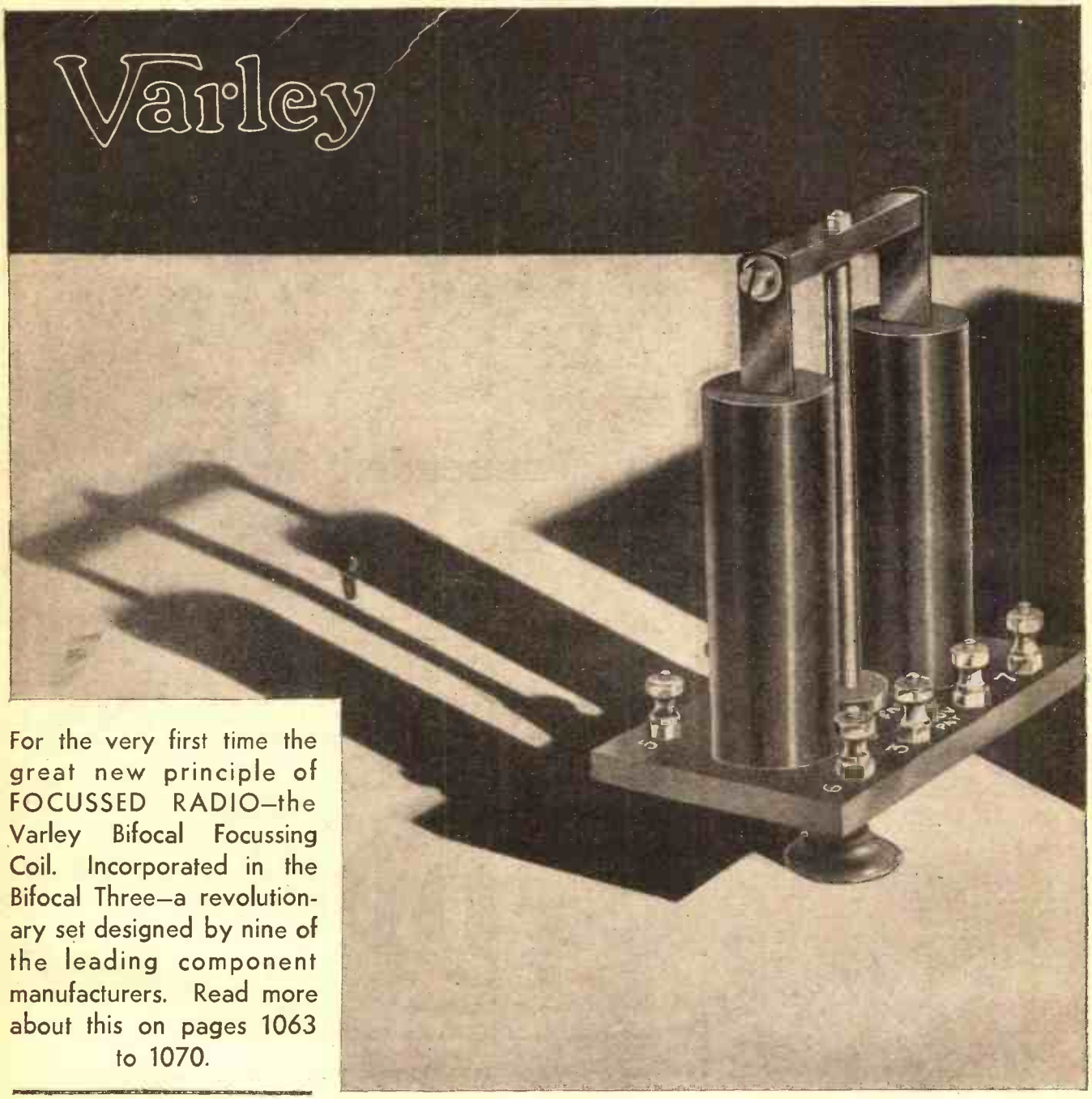

For the very first time the great new principle of FOCUSSED RADIO—the Varley Bifocal Focussing Coil. Incorporated in the Bifocal Three—a revolutionary set designed by nine of the leading component manufacturers. Read more about this on pages 1063 to 1070.

For full particulars of the new Focussing Coils and all that they mean in the future of radio, see the broadsheet enclosed with this issue.

FOREMOST

Advertisement of Messrs. Varley (Oliver Pell Control Ltd.), Kingsway House, 103, Kingsway, London, W.C.2.

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Short Wave Notes

News and comment by radio's foremost short-wave expert.

BY the time you read this the annual Empire tests of the R.S.G.B. will be over. They have amply proved once again my contention that conditions are never really *blank*. During these tests several hundred amateur transmitters throughout the Empire were active each week-end, with hardly a break except for meals and sleep (and precious little of either!).

The result was that one could *always* hear DX signals from some part of the globe. I am more convinced than ever that what we call bad conditions on the amateur bands are simply the result of inactivity and absence of stations.

Conditions Will Improve.

Naturally, this cannot be applied to the short-wave broadcast bands, on which we have high-powered stations operating to regular schedules. Even so, no one with a good receiver can honestly say that conditions are ever really blank. Bad or patchy conditions are, unfortunately, quite frequently met with, but even these will improve as our Eleven-Year Cycle marches on.

(Incidentally, I am told by a reader that it's quite an event for me to get right through my notes without mentioning our big, bad friend the Cycle!)

I have been asked to announce the cessation, with this issue, of "Short-Wave Notes" in its present form. During the six and a half years that these notes have been running I have made more friends than I could possibly count—mostly, of course, through the post.

Next week "P.W.," progressive as ever, is commencing a bigger and better short-wave section. My correspondence has been very troublesome for the last few months, and I have felt that it has been taking up too much space that might be devoted to constructional articles and technicalities.

From now onwards the better part of two pages will be devoted to the short-wave listener. I shall deal, as at present, with readers' problems if they are interesting enough to be thrashed out in public.

Catering for All Readers.

Under the heading of "Short-Wave News" I shall deal with new stations on the air, new short-wave developments and any items of general interest. Finally, there will be something of a constructional or technical nature each week for the benefit of the novice and the advanced reader, in suitable proportions.

'Way back in 1927 the short waves were still a novelty and had very few friends among the great army of home constructors. Now, in this year of grace 1934, more and more listeners are turning to them as an added interest to their work on the broadcast bands.

These waves have been tamed; hundreds of stations are regularly on the air below 100 metres, and development still proceeds apace. My own purely personal view is that in three or four years' time the short waves will be the happy hunting ground of the home constructor, who will take the reception of all Europe on the long and medium waves for granted.

New Circuits and New Ideas.

Very early in the life of the new feature I am starting a special series of articles for the short-wave novice, with the one idea of making his lot an easy one during the trying time of "breaking-in" on a new side of his beloved hobby.

The seasoned short-wave enthusiast, however, will not be forgotten. He will be given new circuits to try out and new ideas on the subject of layout and construction.

I want all my regular correspondents to become more enthusiastic than ever, so that no single item of news will be missed. With their help a short-wave feature of outstanding interest will be possible.

One of next week's items will deal with the best times to listen for the various short-wave stations.

Now it only remains for me, as the writer of "Short-Wave Notes," to bid my readers farewell. But we shall meet again—next week.

W.L.S.

Our picture shows Claude Hulbert and Eve Lecke during a rehearsal for a recording session at the H.M.V. studios.

ROUND THE RECORDS

By K. D. ROGERS.

Selections and recommendations taken from the latest record releases for the benefit of radiogram enthusiasts.

I LIKE to commence these notes with something gay, and this time I have picked out one of the most joyous recordings I have heard for a long time—"The Buggy Ride," by Jack Jackson and his Orchestra, on H.M.V. B6447. Full of pep, and with just the right amount of "nigger" humour, this is certainly not only one of the best recordings of the particular number, but of the February releases.

On the reverse side is "So Shy"—good, but unable to live, up to its companion. For sheer spirits, coupled with perfect playing and superb recording, you should certainly get "The Buggy Ride." I am really *enthusiastic* over it.

Not so invigorating, and, in fact, rather disappointing, I found Isham Jones' recording of "Goodbye Again" and "Little You Know." His orchestra—presumably the same as that chosen to accompany Bing Crosby in his Decca "Lazy Day," reviewed last time—cannot, in my opinion, hold a candle to Jack Jackson in full recordings, though I like its accompaniments. But that may be an opinion I hold alone—try B6443 yourself; you may decide I am wrong.

Two Piano Medleys

Two discs of which I am very fond are piano medleys of hits of the past. One is "Dancing Days," by Carroll Gibbons, on Columbia DB1261, and the other is by Laddie Ray, "Musical Comedy Memories" on Rex 8100. With these two we are pleasantly transported back to the early 1920's with such memory refreshers as *Whispering, Japanese Sandman* (how that latter has kept in popularity!), *Whose Baby Are You* on the Columbia, and *Tea For Two, I Want to be Happy, Indian Love Call, Lover, Come Back To Me*, etc., on the Rex. And only 3s. 6d. for the two!

The B.B.C. Dance Orchestra, directed by Henry Hall, has recently given us "My Song Goes Round The World" and "My Only Souvenir Is You" (Columbia CB694). I have no quarrel with the recording: it is excellent, and followers of Henry will do well to hear this disc. But I do wish he would get another arranger—even if it means sacking himself from the job! Rhythm is the aim of a dance band, but not monotony, and though I agree with Henry Hall's policy of retaining melody, this should not necessitate dullness and unimaginative playing.

What About British Composers?

I am rather tired of the "hooey" that goes on about American composers—often at the expense, in omission, of perfectly good British melody makers. We have heard all we want about John W. Green ("He wrote *Body and Soul*"), of America—his latest record is entitled the phrase in brackets, by the way—and it is time we blew some British trumpets. What about Ray Noble (he wrote *Goodnight, Sweetheart*), who, I am sure, has registered as many hits as J. W. Green, Esq. And there is Leslie Sarony, too. But we always take our metaphorical hat off to the foreigner, especially if by so doing we can sweep it in the faces of our own nationals.

The American gentleman just referred to has recorded a piano medley of his hits in somewhat untuneful style on Columbia DB1262. After you have heard it think about such numbers as those mentioned above, and *Love is the Sweetest Thing, Show Me the Way to Go Home, Love Locked Out* and a few other British winners.

Three last dance numbers—Ambrose and his Orchestra playing "This Little Piggy Went to Market" (Brunswick 01694) and Roy Fox and his Band on Decca F3856 and F3880, giving us "At the End of the Day," "I've got a Shoe," and "Play to Me, Gipsy" and "Lonely Lane." You'll like these.

Before I go on to the more serious side I must mention "Britain's Bing Crosby" crooning "Everything I Have is Yours" and "That's Me Without You" on Decca F3853. It is excellently recorded, and the vocalist, as you have probably realised, is Al Bowlly. It's a good record.

We will go gently into seriousness by way of the "Londonderry Air" and "Annie Laurie," played by Alfredo Campoli (violin), accompanied by the cinema organ of the Granada, Walthamstow. This is on Decca F3868, and should be an extremely good seller. The violin is well reproduced and the organ is exceptionally full in tone. We shall hear much more of Campoli.

Another light item is that of the London Palladium Orchestra playing "The Whistler and His Dog" and "The Warbler's Serenade" on H.M.V. B8004. The famous animal and bird mimic "Imito" has been requisitioned to give the "effects" in these famous compositions, and that in itself is sufficient guarantee of their realism. Good light entertainment.

If you are a pianoforte enthusiast you will thoroughly enjoy Mischa Levitzki's rendering of Liszt's "Hungarian Rhapsody No. 13." This forms a twelve-inch H.M.V. (DB1905), and is a superb piece of recording.

A Musical Souvenir.

Are you fond of military bands? If you are, and have a good radio-gramophone, you should get Columbia DX564, on which the B.B.C. Military Band play the Ballet Dances 1, 2, 3 and 4 from "Prince Igor." The depth of this recording is outstanding; the brass is exceptionally well reproduced, and the full range of the band is perfectly recorded.

One final word. For the benefit of film fans, and in aid of the Cinematograph Trade Benevolent Fund, Brunswick have just issued a unique ten-inch record (01707). It contains short musical excerpts, just vocal souvenirs, of over a dozen popular film and radio stars, including Mae West, Marlene Dietrich, Bing Crosby, The Boswell Sisters, Gertrude Lawrence, Kate Smith and Al Jolson. Buy a copy and benefit yourself and the fund to which the proceeds are being devoted.

TELEVISION PROGRESS

"CARRYING" THE PICTURE

A POINT has now been reached in television where the technique of converting a picture, first into an electric current and then back again into visible form, presents less difficulty than the problem of finding ways and means of transmitting it through the ether: without interfering, that is to say, with the existing broadcast service.

Not, of course, that we have reached perfection even as regards reproduction. But with the aid of the cathode-ray tube a picture can now be scanned at anything up to 240 lines an inch, which is quite sufficient to give a very high standard of definition.

The Problem of Space.

In other words, a television programme of reasonable interest value is already "on the cards"—provided room can be found for it in the ether.

The crux of the matter is that as quality is improved—by increasing the number of scanning lines—a wider frequency band must be used to "carry" the picture through the ether from transmitter to receiver. It is clearly impossible to ask half of the European broadcast stations to close down merely in order to make room for a television service—though something of the sort would be necessary to transmit a high-grade picture programme on the medium waveband.

One possible solution is to allot the ultra-short waveband—say from seven to twelve metres—to television, keeping the present broadcast waveband as it is. This would certainly provide room for both sound and picture programmes without mutual interference. Unfortunately, at present the missing link is a simple yet reliable 7-metre receiver.

Another alternative is to distribute television programmes by wired wireless over a special type of "transmission line" which is capable of carrying a million-cycle band of frequencies without attenuation. This may sound all right in theory, but it would prove too expensive in practice to appeal to more than a limited circle of subscribers.

A Completely New System.

In these circumstances special interest attaches to the work of an English inventor—Mr. G. W. Walton—who has put forward an entirely new system of television which he claims can be radiated on a wavelength of 1,000 metres without causing any interference with the ordinary broadcast programmes.

We know, of course, that there are certain "secret" methods of transmitting sound signals so that they cannot be received on any ordinary set. Similarly, the present idea

An entirely new approach to a solution of one of television's chief problems has recently been opened by an English inventor. His scheme enables a 1,000-metres wavelength to be used without causing the usual interference, and its principles are here interestingly outlined

By J. C. JEVONS.

is to radiate television signals in such a way that they can be readily received on a specially designed circuit, though they will not affect the standard type of receiver. This obviously is a very great asset in that it means that the television broadcast will not interfere with ordinary listening.

The scheme is, in fact, based partly on the use of an ingenious system of scanning and modulation and partly on the use of a special type of receiver.

The scanning system is shown in Fig. 1. One essential element is a "grid" G built up of a number of thin glass plates, as shown in detail in Fig. 1A. Light from the picture to be televised is first focused by a lens L on to this grid.

In passing through the thickness of each strip of glass the ray is subjected to a number of internal reflections, which have the effect of "averaging out" the light intensity of each small area. In other words, the emerging light consists of a number of separate "points," each of which is of uniform light intensity, though taken in bulk they represent the equivalent light value of the original picture. This method of analysing the picture plays an important part in determining the manner in which the signals are subsequently radiated.

Scophony Scanning.

The next step is to pass the "converted" picture through a focusing lens L 1 on to a series of special lenses marked S, which are arranged in "stepped" formation so as to throw the original square or rectangular picture into one long strip. This method of scanning, it may be mentioned, is used in the Scophony system of television, and has the advantage of allowing a small vibrating mirror to be used instead of the usual rotating disc.

From here the "line image" is thrown by a vibrating mirror M across a photo-electric cell C, the output of which is fed through suitable amplifiers to the transmitting aerial.

Suppose the grid G to be built up of 150 strips of glass and the "stepped" lens device S to consist of 100 elements. Then, if the picture is scanned 20 times per second, the resulting frequency of the currents generated in the photo-electric cell will be of the order of 300,000 cycles a second.

In other words, we are now handling frequencies equal to a wavelength of 1,000 metres, so that they can be fed directly to the transmitting aerial without using any carrier-wave.

The radiation has this peculiarity: Owing to the "uniform" intensity of the individual light "areas" after they have passed through the grid G, the fluctuations of current should have the stepped formation shown in Fig. 2 (A).

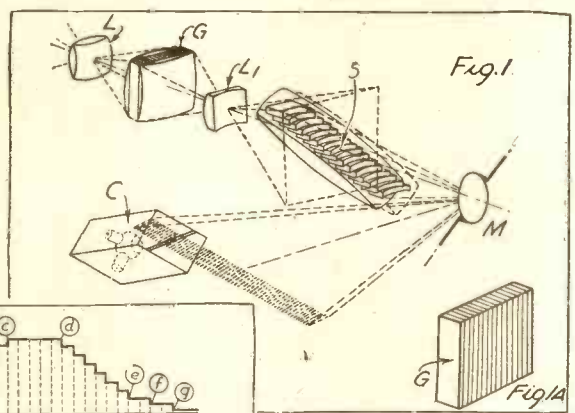
"Rounding Off" the Curve.

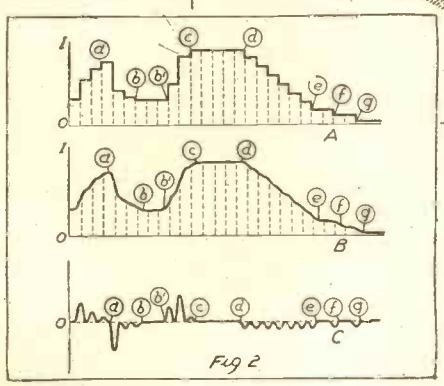
The lens of the photo-electric cell is, however, made of varying transparency, so that this curve is "rounded off," as shown in Fig. 2 (B), in which corresponding points to those on curve A are marked by similar letters.

The important point to notice is that all the flat portions such as those marked *b* to b^1 and *c* to *d* are approximately the same in each case. These, of course, correspond to parts on the picture of uniform light value.

But because the output from the photo-electric cell in Fig. 1 is transformer coupled

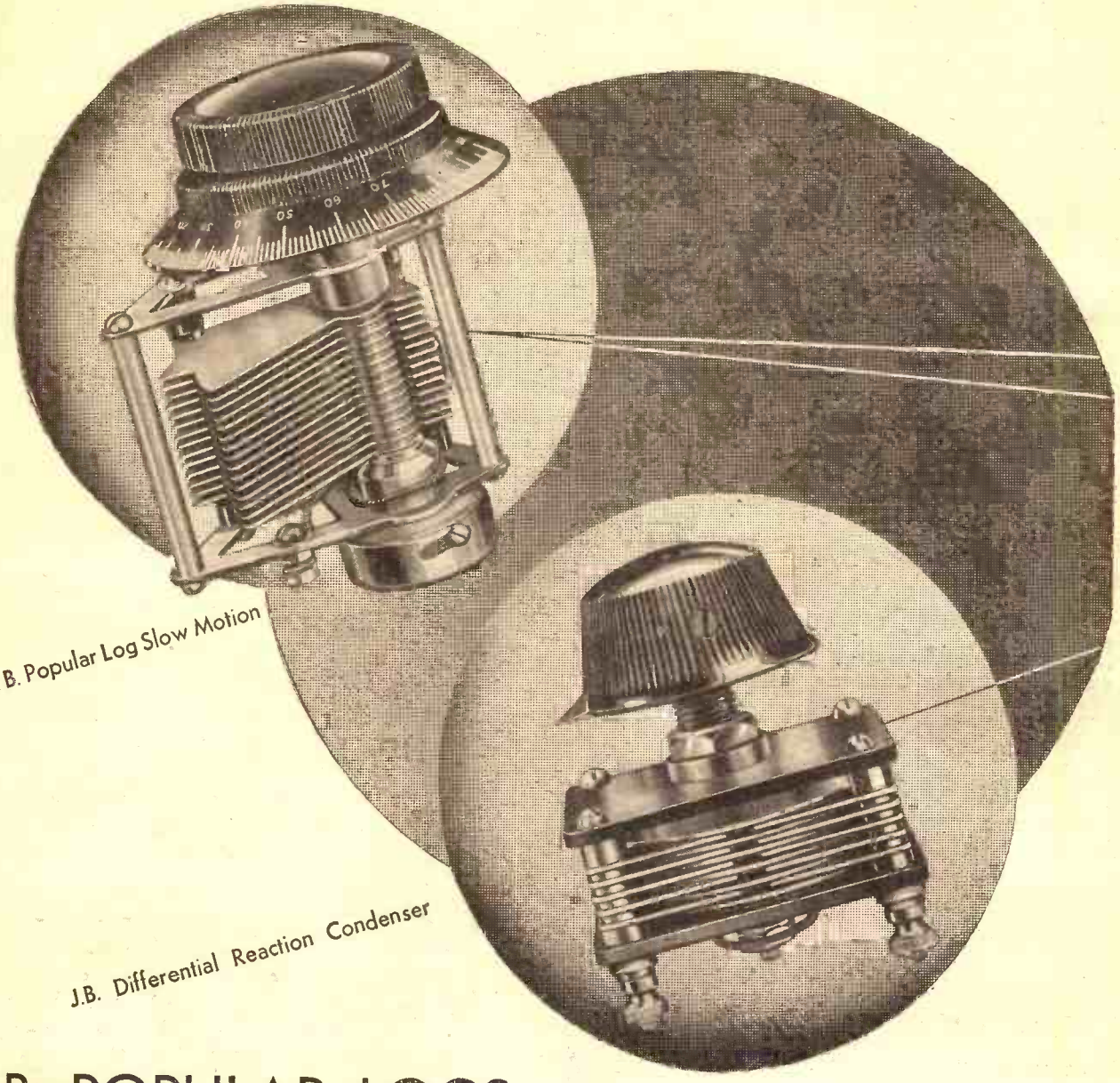
(*Continued on page* 1094.)





How the light is handled is depicted in the upper sketch, while to the left the resultant waveform is analysed to show how an ordinary set is almost unaffected by a television transmission using this system.

ESSENTIAL FOR



J.B. Popular Log Slow Motion

J.B. Differential Reaction Condenser

2 J.B. POPULAR LOGS

Slow Motion. Fitted with the J.B. D type Slow Motion Mechanism. Price complete with 3-inch dial and knob. ·0005. **7/6**

1 J.B. DIFFERENTIAL RE ACTION CONDENSER

Bakelite dielectric between vanes makes short circuit at normal voltage impossible. Price complete. ·0003. **4/6**

PRECISION

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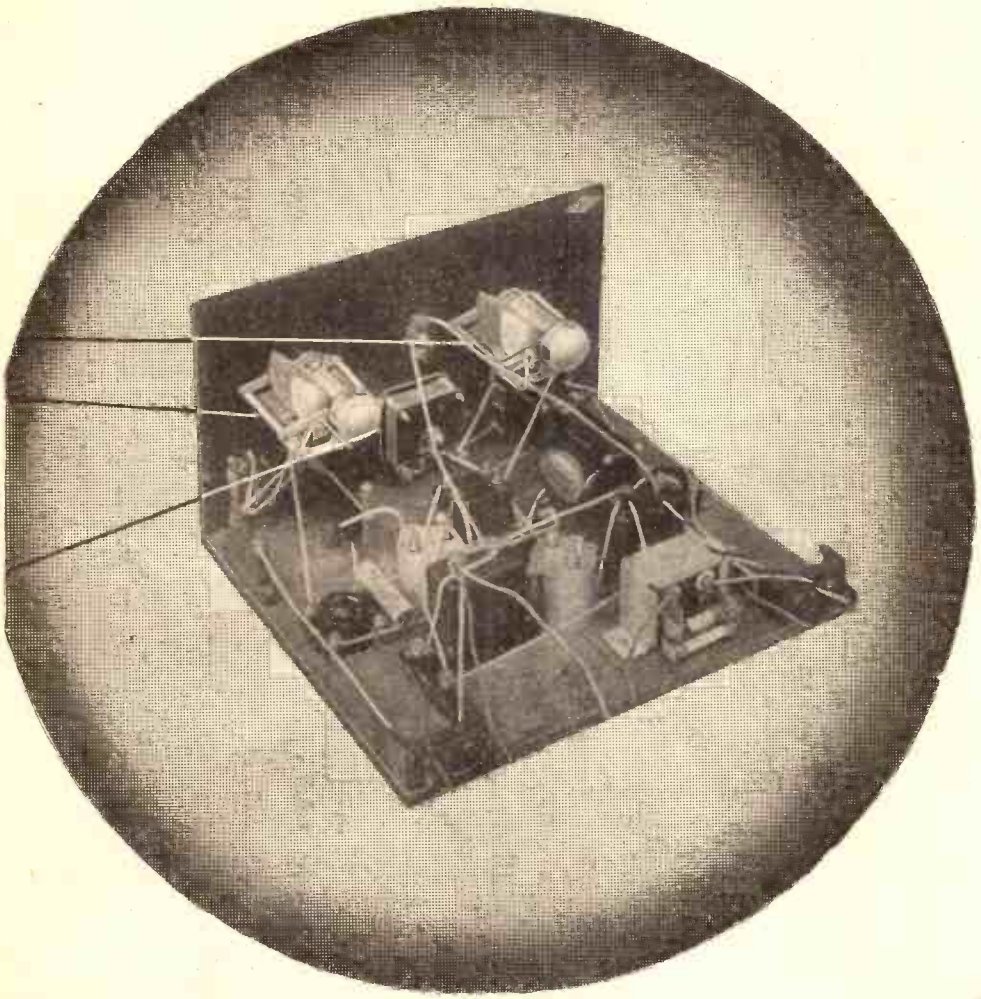
THE BIFOCAL THREE



All Constructors of the Bifocal Three who confine themselves to the specified Components will be guaranteed the results claimed by this wonderful Set.

J.B. IS UNIVERSALLY ACKNOWLEDGED TO MEAN COMPLETE EFFICIENCY AND ADVANCED DESIGN

Designed by nine of the leading component manufacturers—Therein lies the success of the Bifocal Three—Every component used is therefore the best of its kind—the J.B. Popular Logs and Differential Reaction Condenser for instance. You will find further information about this so very up-to-date set on pages 1063 to 1070

REG TRADE MARK

INSTRUMENTS

72, ST. THOMAS' STREET, LONDON, S.E.1. TELEPHONE: HOP 1837

Ways in which fine quality on local-station listening may be obtained from a simple receiver are dealt with this week by our Chief Radio Consultant, who gives practical advice on what should be put into the circuit—and what should be left out.

IMPROVEMENT piles on improvement in the progress of reception technique.

Failure after failure marks the retrogression of transmission. The former improves selectivity; the latter demands it. They about cancel one another.

And the balance leaves us with poor quality and the local programme.

* * *

I have been doing experiments which have the simple object to get good-quality reproduction, which is to be made available to all. And by all I mean all.

"I Want Top."

Day after day, characteristic after characteristic, I say: "Yes, I don't want treble; I want top. I don't want high C; I want the final quivering ripple on the harmonic of the bat's squeak."

I am interested in a d.b. at 8,000, and I will not subscribe to the idea that over a wide range "a few d.b.'s don't matter."

When compromise demands sacrifice one must study one's best way to compromise. When it seems that hope of real quality exists there is no compromise.

The results are really astonishing. It might amuse some of you to attempt to repeat them.

Resistance Coupling.

All you want is a strong local station transmitting studio stuff—and circuits which are as flat as possible, and resistance-capacity technique, and particularly an intention to make the volts fed into the loudspeaker coil truly constant over all the range. It is a very difficult problem if you want a ubiquitous set and haven't got measuring instruments, but it's not difficult if you adopt a "flat" technique.

I mean, you must forget tuning as such because I am assuming you have a strong local station. Put up a big aerial and do not even use a high-frequency valve; just get a closed circuit across the grid-filament circuit of a power grid-leak detector, and use resistance-capacity magnification for the detector output.

Don't stunt; don't "pentode it" up from the detector. Use, if you can, valves of low impedance—not because this is the best technique, but because it allows you to be sure of your result without having to measure everything.

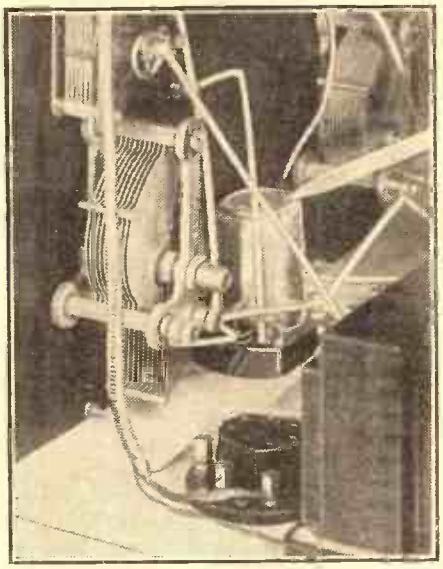
Choke-Capacity Output.

Your loudspeaker transformer may be of the pentode type. If it is, don't use it. Loudspeaker transformers usually have tappings either for pentode or for ordinary power output triodes; use the latter. Better, use choke-capacity output on the last stage—this will prevent transformer core saturation.

I do honestly assure you that the results will astound you if you get things right; but, of course, you cannot expect to get any station except the local, and you must be within 10 miles, say, of that local to get the very best results of quality.

To the more ingenious among you who have both time and money I suggest the line somehow to push up reproduction around 7,000 to 9,000 cycles. You can do this, perhaps, by forms of filters or by using band-pass circuits intelligently.

"IRON-CORE" TUNING



"The majority," says P. P. E., "should be more and more interested in high-frequency pentodes and iron cores for high-frequency inductance coils." Here is the H.F. end of a modern receiver design employing an iron-core tuning coil.

* * *

But I have to leave the discussion of a subject which can only appeal to a minority. The majority should be more and more interested in high-frequency pentodes and iron cores for high-frequency inductance coils.

I did not include these specifically in the "National Three" because it is essential, in obeying the specification I was given, to concentrate on designing on the basis of the well known. We've yet to feel our way towards stability in this new technique.

The high-frequency pentode achieves two remarkable things—it is more stable and yet more sensitive than the ordinary H.F. valve. The superior inter (acting) electrode screening is partly responsible for both these factors. Screen the external circuits of a high-frequency valve as you may, nevertheless retroaction will take place more and more as sensitivity increases, due to valve electrode coupling.

Excellent for A.V.C.

The new valves are excellent for A.V.C. working, too, because changing their grid potential does not change the effective tuning of the circuits with which they are associated so much as with high-frequency valves.

Yes! We get on, but the Lucerne Plan puts us off . . .

* * *

Permeability tuning has been written about a bit. In spite of this, it's a "good thing." Superficially it raises the sensitivity of circuits in which it is used.

Ingeniously it can be made to make these circuits behave in a uniform manner over the whole gamut of "broadcasting" frequencies. It meets the superhetcrodyne on its own territory and challenges that quality of constancy of performance by which most people recommend the super.

A Leading Question.

What I want to know is, does a "super," depending upon the exactitude of square law in the first detector, give quality which is without reproach?

I am asking for information, not attempting to prejudge the reply—because quality is rather important!

In the meanwhile, the H.F. pentode is more stable qua valve than the ordinary H.F. valve, and we can make use of this quality by the higher impedance iron-core inductance, and we can stabilise the resulting more sensitive arrangement because the pentode is well and truly screened.

"SUCH A FINE SET"

The Editor, POPULAR WIRELESS.

Dear Sir,—It is now almost two years ago since I built "the set" from your valuable paper, POPULAR WIRELESS, the "Cosmic Three," and I would like to thank your technical staff for presenting such a fine set.

My "Cosmic Three" has been going strong the whole of the two years, and for volume, selectivity and tone I can only say it is really wonderful.

I have nothing but praise for such a fine set, and have always been thankful to POPULAR WIRELESS for enabling me to build such a wonderful set

Wishing your paper the best of luck,

Yours faithfully,

W. H. GOSS.

1, South View Terrace, Bourne End, Bucks.

The B.B.C. *and* TECHNICAL DEVELOPMENT

Our special investigator reveals some interesting facts in connection with the Empire short-wave service, television experiments and the general technical policy of the B.B.C.

IN a few months the Empire short-wave programme service of the B.B.C. will celebrate its second birthday. Of course, for several years before the official B.B.C. service was begun regular experiments took place and a great deal of technical data was collected.

The problem of programmes, however, had not been explored. So the time is now approaching when, both on the technical and programme sides, the B.B.C. must make up its mind first of all whether it is worth going on with the Empire service, and, if so, then what changes should be made as the result of experience.

"Great Progress Has Been Made."

There is no doubt that, technically, great progress has been made. Lonely Britishers in the outposts of Empire all over the world have found the B.B.C. Empire service a great boon. Although broadcasters in the Dominions and Colonies have not been over-anxious to relay the B.B.C. programmes locally, enough of this has been done to justify serious consideration for the future.

Nevertheless, it has to be kept in mind that the Empire service cost about £40,000 to start, and about the same figure represents the annual expenditure on maintenance. The service was delayed two years in the hope of money contributions from the Dominions and Colonies, which were not forthcoming. The service was started and approved by Parliament on the clear understanding that it would not be conducted indefinitely at the cost of the British listener alone.

Many Listeners in the U.S.A.

About the degree of acceptability of the programmes there is some conflict of evidence. For the direct listener, wherever he lives, the programmes as at present given seem satisfactory. Curiously enough, it seems to be in the United States that the bulk of this direct listening is done. The B.B.C. correspondence from American listeners is as great as that from listeners in all other parts of the world.

Although in New Zealand and Australia there is a certain amount of relaying of the short-wave programmes, other parts of the Empire and the world have not followed suit. Canada is particularly reluctant, but this is no doubt at least partly due to the state of transition of the organisation of broadcasting in that Dominion. There is, however, a moral to be drawn for future policy. This, I suggest, is that the B.B.C. should admit the difference between two types of service: the one to the direct listener and the other for relay abroad. For the latter there should be a much smaller proportion of electrical recordings. There should also be a careful study of the local programme arrangements, particularly for timing.

Assuming that the B.B.C. will continue with its Empire short-wave service, it is clearly important to provide for broadcasters in the Dominions and the Colonies special programmes so arranged and timed that they simply have to be included in the programmes of the area to which they are directed. It is only in this way that there can be any hope of spreading the financial burden.

Therefore, in order ultimately to economise on the present rate of expenditure, it is more than likely that the B.B.C. will have to spend more money on its Empire services during the next three years.

Television Considerations.

The B.B.C. has now spent rather more than £15,000 on public and private experiments in television. The bulk of this money has been absorbed by the programme and technical departments for the four half-hours a week of 30-line transmissions which have been going on for the past two years. When these were begun technical research had not reached the stage of deciding whether the future of television would rest with development on low definition or development on high definition.

Recently, however, the B.B.C. engineers, and, indeed, most of the responsible engineers of television companies, have agreed that television of the low-definition kind on medium waves is obsolescent, if not actually obsolete.

Expert attention is concentrated on the possibilities of "cathode-ray" systems to be transmitted on ultra-short waves. It is only reasonable, therefore, that the B.B.C. is abandoning most of the expensive low-definition transmissions. It is impossible to say when the current experiments in high-definition television will reach the stage of programme service. Opinion seems to be that this will be delayed for about two years.

There is no immediate prospect, therefore, of television being added to the normal service of broadcasting.

Effect of the Lucerne Plan.

The application of the Lucerne Plan, with its redistribution of wavelengths, has meant the end of the Regional scheme of broadcasting in Britain as originally designed. The purpose at the beginning was to establish permanently Regional twin-wave transmitters from which would be radiated alternative programmes. Several of the twin-wave stations are already obsolete. Two factors have intervened to make the transition easy. The first is rapid general improvement of receiving apparatus. The second is the reconstruction of Daventry 5 X X at Droitwich, where not only will it be more favourably situated for the widest possible distribution, but also it will be as a transmitter many times more powerful and efficient than the present transmitter at Daventry.

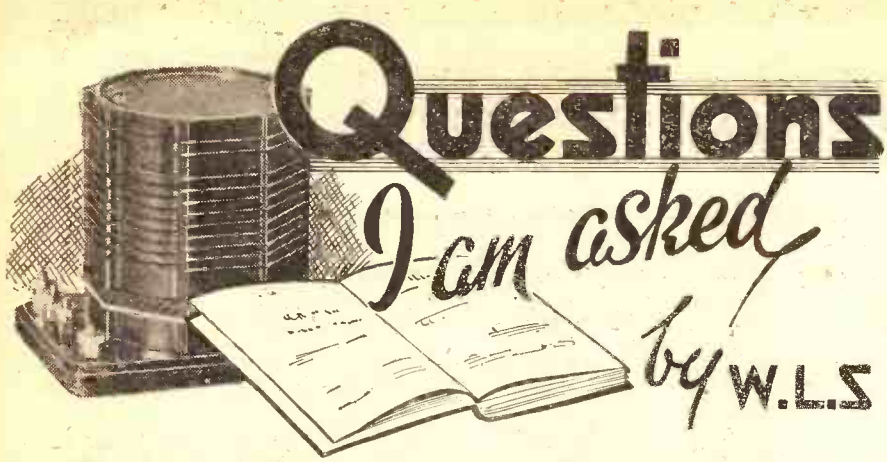
SENDING BRITISH PROGRAMMES TO THE EMPIRE

The station building of the Empire broadcasting service photographed shortly after its completion. In a few months the Empire short-wave service, which cost about £40,000 to start, will celebrate its second birthday.

The recent purchase by the B.B.C. of several acres of new property in Balham is significant of the growing importance of research. It is believed that the application to broadcasting of ultra-short and micro-wave technique may have a revolutionary effect before long. If present experiments yield the results expected of them the whole system of distribution by high-power Regional transmitters may have to be modified once again.

The new developments, if they should materialise, will make it possible to establish a large number of local stations, not only to supplement the central services but also to deal specifically with local needs. This being the case, the B.B.C. would be

(*Continued on page* 1096.)



Our popular short-wave contributor deals with a number of the most common queries he receives from readers interested in reception below 50 metres.

THERE must be something about short-wave work that encourages a tremendous thirst for information. About once a week I receive a letter full of news that does not conclude by asking six or seven questions. Half the remainder are of the "fifty-fifty" variety; while those that are left are simply a long string of questions beginning "Dear W. L. S." and ending "Yours sincerely."

I have allowed some of the questions that really are of general interest to accumulate, and I will do my best to answer them herewith.

A Common Complaint.

First I will take a very common complaint. "I have made up the So-and-So Two (or the What-is-it Three) *exactly* to specification. It works beautifully above 30 metres with the 6-turn and 9-turn coils, but when I try two 4-turn coils, or one 4 and one 6, it won't oscillate. Is it the coils or something else in the set?"

You wouldn't believe the number of times that question reaches me in various forms. It seems almost incredible to me that readers should have difficulty, in these days of high-efficiency valves, in making their detectors oscillate below 30 metres; but there it is—and you can't get away from these queries!

Care Needed in Building.

My first words of advice to the senders of this type of query, given without the slightest intention of being offensive, are these: "Take more care about the way you make the set." In nine cases out of ten that sums up the entire difficulty.

Bad layouts, dirty contacts, old and worn-out components, straggly wiring—all these are fatal in a short-wave set.

Having seen several specimens of readers' sets, I am inclined to add, for the benefit of the untidy few: "Wipe the dirty flux off your components when taking them out of an old set and putting them in the new one; screw everything down on the baseboard; and use clean wire for wiring them up."

If you follow the author's layout, even roughly, and use good components, and try to make the whole thing look pretty, there is no reason whatever for failure. The tests to which every set is submitted by the Research Department are far too stringent for a "dud" to get through. Therefore, if you will pardon my saying so, failure to get results almost invariably reflects on *you* and not on the designer.

Difficult to Answer.

So much for Query No. 1. Next in order on the list comes a question that is absolutely impossible for me to answer comprehensively. Here it is, quoted verbatim from a reader's letter: "Will you give me some idea of the best times to listen for short-wave stations?"

My usual answer is, "When you hear them," but I admit that that is not very informative. The trouble is that week by week, and even year by year, the "best times" are constantly changing. Also the best time for hearing a station depends upon (1) its wavelength; (2) its distance; (3) its direction; (4) the season of the year; and (5), to a certain extent, upon the location of the receiver.

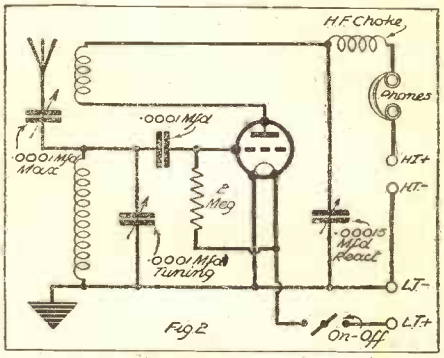
No Golden Rule.

There can be no golden rule in this matter. The most definite information that I can give concerns just a few groups of stations. For instance, all the year round the various American broadcasters between 45 and 50 metres are generally at their best between 11 p.m. and 3 a.m. In the winter the peak may be between 11 p.m. and midnight; in the summer you will probably have to sit up a little later.

I can also say fairly definitely that Sydney, V K 2 M E, who is the only Australian broadcaster that can be counted upon with any regularity, may often be heard between 6 and 8 a.m. on Sundays, and possibly, at certain times of the year, right through the morning, sometimes lasting till 2 or 3 p.m.

When you have been playing with short waves as long as I have you develop a kind of instinct that guides you to the receiver at the times when interesting things are happening. Until you have acquired that, the only advice I can give you is to listen as often as you feel inclined and to log everything that you hear—station, approximate wavelength, time and date. You will soon collect quite a useful lot of data.

SIMPLE AND EFFECTIVE



An easy-to-build single-valver that is economical and efficient.

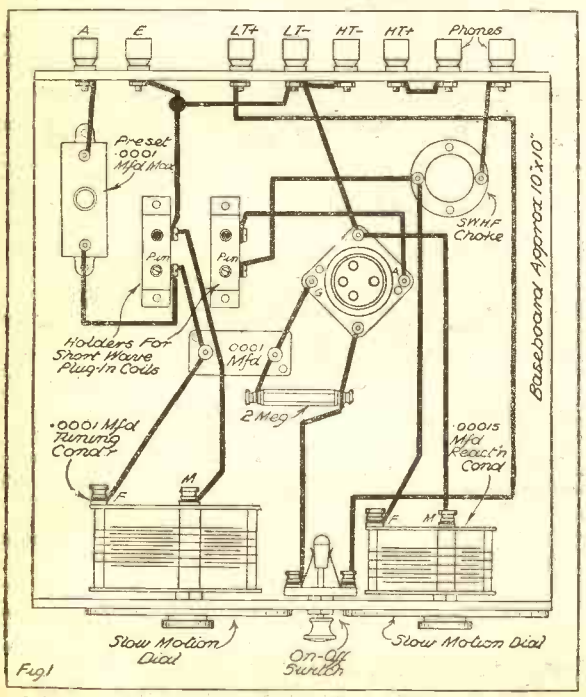
The Set to Start With.

No. 3 is another very comprehensive query. "What kind of set do you advise for a raw novice at short-wave work?" Here I *can* give a definite answer. If it is to be your first attempt I advise either a single-valver or a "two" of the detector-and-L.F. type. The construction is simple; there are no particular snags if you build the set from a good design; and you are sure of hearing something almost at once.

"Nothing succeeds like success," and once you have had your ears pleasantly tickled by interesting sounds you will certainly persevere. If you start right away on a superhet or any other elaborate kind of receiver you may possibly strike trouble and be disheartened.

The diagram on this page shows a suitable baseboard layout for the very simplest of short-wavers, and should be detailed enough to start some of those who read this on their quest for short-wave DX.

VERY EASY TO CONSTRUCT



A layout suggested by W. L. S. for the straightforward one-valve short-wave circuit shown in Fig. 2.

BIFOCAL THREE

PILOT AUTHOR KIT
EXACT TO SPECIFICATION

The Pilot Kit SERVICE was founded in 1919.

See the PILOT on the carton. It's a real guarantee.

S.T. 500

KIT "A" Comprising Mr. John Scott-Taggart's Kit of FIRST SPECIFIED Components, including Telsen Class B Output Choke, Peto-Scott "Metaplex" Baseboard and Ready-drilled Panel and Terminal Strip. Less Valves and Cabinet. With FULL-SIZE Blue Print and copy of "Popular Wireless" Oct. 21st. Cash or C.O.D. Carriage Paid. **£5-5-0**
or 12 monthly payments of 9/6

KIT "B"
As Kit "A," but including 4 Specified Valves. Cash or C.O.D. Carriage Paid, **£7-10-3**
or12 monthly payments of 13/9.

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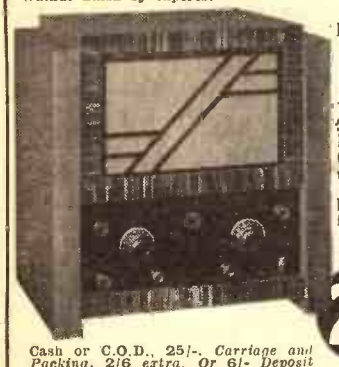
As Kit "B," but including Peto-Scott Specified Walnut Table Cabinet. Cash or C.O.D. Carriage Paid, **£8-9-9**
or12 monthly payments of 15/6.

KIT "CC" As Kit "B," including Peto-Scott Specified Walnut Consolette Cabinet. Complete with Baffle Baseboard Assembly, but less Speaker. Cash or C.O.D. Carriage Paid **£8-19-9**
Or 12 monthly payments of 16/3
If Peto-Scott Permanent Magnet Speaker required add 19/6 to Cash Price or add 1/9 to each monthly payment.

S.T.500 CONSOLETTE

An outstanding example of cabinet craftsmanship. Hand French polished. Veneered Macassar and Walnut finish by experts.



Panel size: 16" × 7". Baseboard. Size: 16" × 12". Top Loud Speaker and Battery Compartment, size, 16" × 10" high × 12" front to back.

25/-

Cash or C.O.D., 25/-. *Carriage and Packing, 2/6 extra. Or 6/- Deposit and 4 monthly payments of 6/- (including carriage and packing). Baffle-Baseboard Assembly, 3/6 extra.*

ECKERSLEY NATIONAL 3

KIT "A" Author's Kit of first specified parts, including **READY - DRILLED PANEL** and **METAPLEX** chassis assembly, but less valves and cabinet. Cash or C.O.D. Carriage Paid ... ... **£5 : 10 : 0**
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As Kit "A," but including set of specified valves, but less cabinet. Cash or C.O.D. Carriage Paid, £7/9/0, or 12 monthly payments of 13/9.

KIT "C"
As Kit "A," but including valves and Table cabinet. Cash or C.O.D. Carriage Paid, £8/6/6, or 12 monthly payments of 15/3.

PETO-SCOTT ALWAYS TO THE FRONT
FIRST WITH EASIEST OF EASY TERMS

KIT "A" CASH or C.O.D. £5 . 15 . 0

These are the Parts the Designers Used

	£	s.	d.
1 **Peto-Scott** plywood baseboard, 12 in. × 10 in. × ⅜ in...		1	3
2 **Varley** Bifocal Focusing Coils ..	1	1	0
2 **J.B.** ·0005-mfd. condensers Popular Log type		15	0
1 **Benjamin** on-off switch			9
1 **J.B.** ·0003-mfd. diff. condenser, type 1080		4	6
2 **Bulgin** wave-change switches, type S.105		6	0
1 **Peto-Scott** ready-drilled panel, 12 in. × 7 in.		3	6
1 **Ferranti** type A.F.4 L.F. transformer..		17	6
2 **Dubilier** ·0005-mfd. condensers, type 620		2	6
1 **Belling-Lee** S.G. anode connector ..			4
1 **T.C.C.** ·0001-mfd. condenser, type 34..		1	3
2 **Benjamin** 4-pin valve holders. "Vibrolda"		1	8
1 **Benjamin** 5-pin valve holder, "Vibrolda"			10
1 **Dubilier** 2-meg. resistance		1	0
2 **Bulgin** screened Standard H.F.9 chokes		7	0
1 **T.C.C.** ·1-mfd. tubular condenser, type 250		1	4
1 **T.C.C.** 2-mfd. condenser, type 50 ..		3	6
1 **Dubilier** 2-mfd. fixed condenser, type BB		3	6
1 **Ferranti** new type 5,000-ohm resistance		1	0
1 **Benjamin** "Autocontrola" unit ..		7	6
1 **Westinghouse** Westector W.6..		7	6
1 **Dubilier** 100,000-ohm 1-watt type resistance		1	0
2 **Belling-Lee** terminal mounts fitted with 4 type R terminals		2	0
1 **Ferranti** new type 50,000-ohm resistance		1	0
Wire, screws, flex, etc...		2	7
KIT "A" Cash or C.O.D. ..	**£5**	**15**	**0**
Set of **Specified Valves**	**£1**	**19**	**0**

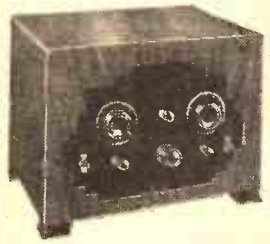
KIT "A" Author's Kit of First Specified parts, including Ready-drilled Panel, Baseboard and Westector, but Less Valves and Cabinet. Cash or C.O.D. Carriage Paid. **£5 : 15 : 0.**

Or Yours for 10/6
Balance in 11 monthly payments of 10/6.

KIT "B"
As for Kit "A" but with Valves only. Cash or C.O.D. Carriage Paid. **£7:14:0.** Or 12 monthly payments of 14/-.

KIT "C"
As for Kit "A" but with Valves and Peto-Scott Cabinet. Cash or C.O.D. Carriage Paid. **£8 : 11 : 6.** Or 12 monthly payments of 15/9.

RECOMMENDED
PETO-SCOTT *Walnut* CABINET



This handsome walnutpolished cabinet is constructed throughout in first quality material and beautifully hand french-polished. Macassar veneers. **CASH OR C.O.D.**

17/6
Packing and Carriage 2/6 extra.

SEND FOR 1934 CABINET CATALOGUE.

CASH, C.O.D. or EASIWAY

TELSEN S.G.3

Complete **Telsen S.G.3.** Kit in Sealed Carton less Valves. Cash or C.O.D. Carriage Paid. **£1 : 19 : 6.** Balance in 9 monthly payments of **4/6.**

4/6 DOWN

Telsen S.G.3 Kit with 3 Mazda Valves. Cash or C.O.D. Carriage Paid, **£3/18/6.** Or 7/3 deposit and 11 monthly payments of 7/3.

Telsen S.G.3 Kit with Valves and Cabinet, as illustrated. Cash or C.O.D. Carriage Paid, **£4/13/6.** Or 8/6 deposit and 11 monthly payments of 8/6.

If **Peto-Scott Permanent Magnet Moving-Coil Speaker** required, add 19/6 to Cash Price, or 1/9 to each monthly payment.

IMPORTANT **Miscellaneous Components,** *Parts, Kits, Finished Receivers or Accessories for Cash, C.O.D. or H.P. on our own system of Easy Payments. Send us a list of your wants. We will quote you by return. C.O.D. orders value over 10/- sent carriage and post charges paid* **(GREAT BRITAIN ONLY).** *OVERSEAS CUSTOMERS CAN SEND TO US WITH CONFIDENCE. We carry a special export staff and save all delay. We pay half carriage—packed free. Send full value plus sufficient for half carriage. Any surplus refunded immediately.* **Hire Purchase Terms are NOT available to Irish or Overseas customers.**

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THE MIRROR OF THE B.B.C.

CHRISTOPHER STONE FOR AMERICA

The R.M.A. and Future Programmes—Plays After 10-30 p.m.—Prisons and Punishments.

REFLECTIONS BY O.H.M.

DEFINITE rumours reach me that Mr. Christopher Stone will tour America for three or four months this year, probably starting in April. He is already well known to and liked by the steadily growing body of American listeners to B.B.C. programmes. His advent to the American microphone will be an interesting experiment.

Mr. Wilding Cole at Work.

Mr. Wilding Cole, the new Chairman of the Radio Manufacturers' Association, has begun his term of office with characteristic energy and directness. So far as the broadcasting end was concerned, Mr. Cole went straight to the top, having a long and frank preliminary talk with Sir John Reith, to whom he introduced Major Robertson, the new liaison officer between the trade and the B.B.C. Important proposals for developing programmes will be made shortly by Mr. Wilding Cole and his Council. Indications are that the R.M.A. will have a good deal to do with the planning of the B.B.C. programmes in the future.

Canadian Radio Producer in London.

Mr. Forbes Randolph, famous throughout North America as a producer for the stage and the film, as well as for radio, has come to London, and is to undertake several important productions, one at least for the B.B.C. Mr. Randolph has had spectacular successes in New York, and his work here is looked forward to with unusual interest.

Alternatives to Late Dance Music.

I hear that it is now practically certain that the B.B.C., in its autumn arrangements, will allow for alternatives to dance music from 10.30 to 11.15 p.m., usually in the form of a play or sketch. It is doubtful whether this concession will altogether satisfy the growing number of listeners who have been asking for a late night alternative; it would be better to offer symphony or light music from 10.30 to midnight.

New Announcers to be Heard.

Great efforts are being made to strengthen the standard of announcing, and new voices will be heard shortly. These, however, will not interfere with the frequency with which the voices of Stuart Hibberd and Freddie Grisewood delight their listeners. The B.B.C. need not be surprised at the difficulty it encounters in securing suitable candidates for announcers' jobs. As long as the policy is to obscure individuality for the sake of an impersonal standard, so long will this difficulty be present.

The truth is that the few people possessing the unique qualifications required for good announcing are not normally disposed to have their personalities submerged. The B.B.C. would be well advised to reconsider its policy in this connection. The right avenue of development is the road to personality and greater freedom.

A Summer Talks Series.

I hear that, in the plans for the summer talks, as arranged by the Central Council for broadcast adult education, there is to be a series describing the penal systems and punitive measures employed in leading countries of the world.

St. Patrick's Day.

Belfast is again to be responsible for presenting a special St. Patrick's Day programme for the British Isles on Saturday, March 17th. From what we hear it will be less complicated than that given last year, and is to consist largely of music, sung and played, a recital by W. B. Yeats of some of his own poetry, and possibly a relay from the carillon of St. Patrick's Roman Catholic Cathedral at Armagh.

"The Flowers of the Forest."

That famous Scots song, "The Flowers of the Forest," will be included in the next of the series of "Songs from the Shires" broadcast on Wednesday, March 7th, when Selkirkshire is the county to be dealt with. The singer will be John Mathewson.

Midland Region Topics.

Victor Hely Hutchinson, Music Director of the Midland Region, will be represented in two forthcoming programmes. On March 12th he will give a pianoforte recital from the Birmingham studio, while he wrote the music for L. du Garde Peach's "The Charcoal-burner's Son," to be broadcast on March 10th.

GETTING THE RIGHT ATMOSPHERE

Our picture shows a scene from the British International Pictures' film "Love at Second Sight," with the popular Stanley Holloway, as a policeman, chatting with two fair passers-by.

In order to achieve the correct atmosphere of a radio and gramophone shop, Marconiphone were asked to carry out all the furnishing and window dressing after the model of a typical local dealer.

THE LISTENER'S NOTEBOOK

Comment and criticism on recent B.B.C. programmes and personalities.

ANY radio column that deals with microphone personalities, whether to praise or abuse them, must contain some reference to Mr. Vernon Bartlett's departure from the B.B.C. This is the biggest blow to broadcasting that I can remember.

* * *

It isn't my purpose to discuss the facts of the case, even if I knew them. I only know that listeners who, like myself, have relied largely on Mr. Bartlett for information on world affairs will miss him greatly. There are still the papers, I know. But Mr. Bartlett always spoke so vividly and so impartially, and the spoken word as he spoke it has a power not possessed by the written one.

* * *

Mr. Bartlett seems a little bitter about it all. Wasn't it a revelation to hear that he spent that extraordinarily long time in preparing his weekly twenty-minutes' talk? How he strove, too, always to be impartial!

* * *

The question now is: "Where will the B.B.C. look for another?" It must have another! The B.B.C. must recognise that Mr. Bartlett's item is indispensable. People of all classes and creeds have been devoted followers of this great broadcaster. They placed confidence in him, and as he never had an axe to grind they never once doubted his sincerity.

* * *

To find the B.B.C. experimenting is a good sign. It is significant, too, that we should find two innovations just after we had deplored the stereotyped flavour of present-day programmes. I refer to the late broadcast of a play, and "The Farmer's Wife." I think the latter is the more interesting.

When "The Farmer's Wife" was produced in London, so we read, it had an enormous success. And this success was largely due to the fact "that it offered a change from the prevailing fashion of the time." History seems to be repeating itself. Apart from its own merits, "The Farmer's Wife" can claim another success—this time as a broadcast play—for being once again a change from a prevailing fashion. I have often remarked on the one-sidedness of radio drama. We listened to "The Farmer's Wife" with ease and enjoyment. We could do the same to many other comedies hitherto considered unsuitable for the microphone.

If I were in charge of the plays department I would instantly procure French's latest list of released comedies. I would make a careful selection, adapt them and put them on the air forthwith. This would be hard on those authors whose main occupation is to write specially for broadcasting. But listeners would be more certain of getting a play with a plot worth calling a plot. When we listen to a play we do like to be kept guessing till the *dénouement*.

* * *

Melodrama at 10.35 p.m. may suit some folk, but at that hour I am in no mood for it. I did not listen to "Reconnaissance." It is only on rare occasions that I listen in at such an advanced hour. That's why I never decry the late dance music. I am indifferent to wireless programmes then, unless it be a boxing match on the air. I might also be tempted to tune in to a running commentary of any description.

* * *

Light radio entertainment probably reached its highest level with Eric Maschwitz's production of "Love Needs a Waltz." Eric Maschwitz seems to possess an uncanny sense of what's wanted by listeners. Writers and composers of these operettas should have gleaned a good deal from "Love Needs a Waltz" about the necessary ingredients of a good operetta. The book was meaty, the plot was clever and the lines were good. It couldn't but succeed, therefore.

* * *

But it had more than this. Kenneth Leslie Smith's music alone would have justified the production. The story naturally demanded both jazz and waltz-time music, and the rivalry for supremacy between the two was quite apparent. Waltz-time music had a winner in the big number "Love Needs a Waltz." I do hope the "hot" merchants gave it a good hearing. It was a beautiful melody. Jazz hadn't a representative that could hold a candle to it.

A few more shows of this calibre would place the waltz's supremacy beyond doubt. But I'm inclined to regard this production rather as a flash in the pan.

(*Continued on page* 1095.)

RADIO STEP-BY-STEP

Our SPECIAL SUPPLEMENT FOR BEGINNERS

RADIO TERMS

by G. V. DOWDING, ASSOCIATE I.E.E.

A Practical Survey covering every Phase of Wireless.

INTERVALVE COUPLING.

THE apparatus employed to couple the output of one valve to the input of another in a radio set.

IONISATION.

The splitting up of the molecules of a gas into positive and negative particles, which are then called ions. (An ion may consist of one or more atoms of an element.)

Each positive ion is minus one or more electrons. When ionised the gas becomes a conductor of electricity.

Ionisation of air by the rays of the sun causes the conductive layers known as the Kennelly-Heaviside and Appleton Layers. (Conductors of electricity are *reflectors* of wireless waves.)

JACK.

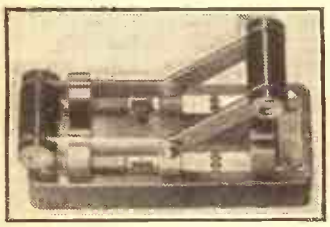
A device that was at one time frequently used in radio sets, but has now, to a large extent, become obsolete It originated in telephone practice and can best be described as a switch socket.

It is not employed alone, but in conjunction with a plug. The insertion of the plug causes desired circuit switching to occur. It is sometimes used with a gramophone pick-up. A plug is fixed to the pick-up leads, and on the insertion of this plug the pick-up is automatically switched into circuit.

KERR CELL.

This is used in connection with certain television systems, and

AERIAL SAFETY



An aerial earthing switch with which is combined a lightning arrester in the form of metal serrations.

it has for its object the transforming of electrical impulses into light variations.

It is placed between two polarising prisms. These prisms are adjusted so that normally negligible light can get through. But varying electrical charges on the Kerr cell give a twisting effect to the light rays, and by thus throwing them out of their plane, as it were, the polarising system is upset and more or less light gets through.

KILOCYCLE.

One thousand cycles. The term is frequently used in dealing with broadcasting stations, particularly where frequencies running into tens of thousands of cycles are encountered. For example, the frequency of a 300-metre transmission is 1,000,000 cycles, or 1,000 kilocycles.

KILOWATT (KW.).

One thousand watts. It is the practical unit of electrical power. The *Kilowatt Hour* is the practical unit of electrical energy, and is used as the Board of Trade Unit, under which heading we have already dealt with it.

LAMINATIONS.

Layers or sheets. The cores of transformers are not composed of solid masses of iron, but are laminated. That is to say, they comprise a number of thin layers of iron, each of which is insulated from its neighbours by means of insulating-varnish coverings.

The object of this is to impede the flow of eddy currents, which would otherwise occasion losses.

LIGHTNING ARRESTER.

An article consisting of a very small spark gap for connecting between the aerial and earth in order to safeguard a receiving installation from the effects of lightning discharges.

When a spark exists across the gap, this becomes a very low resistance path.

LINEAR.

The more technical term for "straight line." An amplifier is said to be "linear" when the output at all voltages and frequencies is directly proportional to the input voltages.

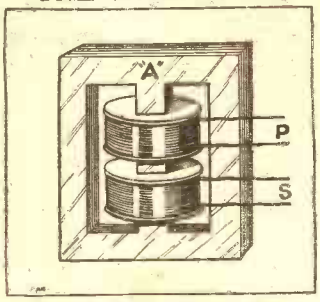
Similarly, a linear detector is a detector having a perfect action.

LINES OF FORCE.

For purposes of calculation a magnetic or electric field is said to comprise a number of imaginary lines along which the electric or magnetic force acts.

And it is the number of these lines which exist in a given cross-sectional area of the field which is the measure of its intensity.

THE ESSENTIALS



The core "A" and the primary and secondary windings are the "working" parts of an L.F. transformer. Their usual disposition is indicated in this sketch.

LOGARITHMIC

When the change between the successive numbers of any series of values is logarithmically proportional.

LOOSE COUPLING.

A weak linkage between two circuits. Loose coupling is achieved with two coils by separating them so that their mutual inductance is small when compared with their individual inductances.

LOW-FREQUENCY.

Also known as audio frequency, this refers to frequencies up to about 20,000 cycles.

LOW FREQUENCY TRANSFORMER.

A component used for coupling two low-frequency circuits. It comprises two windings on an iron core. With the exception of the special type employed in Class B circuits the average L.F. transformer steps up voltage.

The "step-up" is obtained by winding fewer turns on the primary winding than on the secondary. The ratio of step-up, 1-3, 1-4 and so on, is actually the ratio of primary to secondary turns of wire.

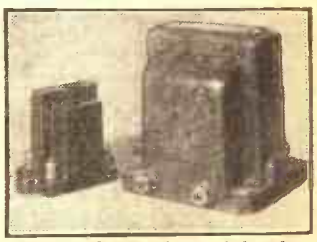
An L.F. transformer cannot by itself amplify, but its ratio directly affects the amplification given by a valve stage, other things being equal. The normal L.F. amplifying valve is voltage operated, and the greater the voltage developed across its grid and filament the greater the output within limits.

Voltage Step-Up.

Therefore an L.F. transformer of the usual step-up kind will enable greater amplification to be obtained than with, say, resistance-capacity coupling, because it steps up the voltage. That the current must correspondingly fall does not matter, for, as we have said, the normal amplifying valve is voltage, not current or power operated.

From this it might be assumed that the ratio of the transformer could be increased indefinitely with consequent great amplification increase. But there are practical restrictions.

TWO TYPES



The size of a transformer is largely dependent on the material used for the core. The small component to the left uses a nickel-iron core, while the other transformer has one of the ordinary type.

The ratio of the transformer is decided by the turns of wire in its windings, as we have seen. If there were 5,000 on the primary and 10,000 on its secondary there would be a step-up ratio of 1 to 2.

To increase this ratio there are two obvious alternatives.

(*Continued on page* 1086)

NEW LINES BY FERRANTI

FERRANTI VALVES

Double diode triode Valve. H.2.D. Filament Volts 2. Filament Current ·1 amp. Impedance 15,400 ohms. Amplification Factor 20. Mutual Conductance 1·3. Maximum Anode Volts 150.
Price 9/-

L2. Filament Volts 2. Filament Current ·1 amp. Amplification Factor 10·9. Impedance 6,800 ohms. Mutual Conductance 1·6. Maximum Anode Volts 150. As a driver it operates with 120 Volts H.T. and 9 Volts Grid Bias.
Price 8/9

Variable Mu screened grid Valve type VS.2. Filament Volts 2. Filament Current ·1 amp. Amplification Factor 440. Impedance 440,000 ohms. Mutual Conductance 1. Maximum Anode Volts 150. Maximum Screened Volts 70.
Price 15/6

Class B Valve Type H.P.2. Filament Volts 2·0. Filament amps 0·4. Anode Volts 150 max. Maximum Anode Current swing 50 m/A. Maximum Peak Applied Signal (grid to grid) 40 volts. Static Anode Current at Va-100, Vg-0, 2·5 m/A total.
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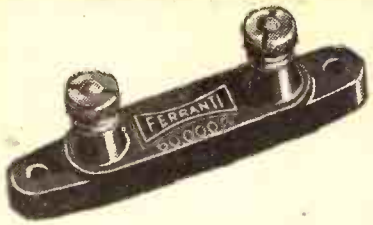
Battery Heptode Valve. Type VHT2. Filament Volts 2. Filament Current ·1 amp. Maximum Anode Volts 150. Maximum Screen Volts 70. Oscillator Anode Volts 120. Price 18/6

BATTERY VALVES FROM HOLLINWOOD

The home of all that's recognised to be best in Radio produces a range of Valves about which the most critical radio experimenters are the most enthusiastic.
Designed and constructed entirely in the famous Hollinwood works, Ferranti Valves have taken their rightful place in the forefront of Progress towards true Radio Reproduction.



NEW-TYPE RESISTANCES

The element is comprised of graphite deposited by a special process on a rod of refractory material. It is enclosed in well-finished bakelite case fitted with massive moulded-in terminals.

They are accurate to within 5% of their rated values, absolutely silent in operation and are specially designed for general de-coupling purposes. Their inductance and capacity are negligible. ½ Watt type. Dimensions ⅞"d. × 2½"l., obtainable in the following values, Price 1/- each:

300, 500, 750, 1000, 2000, 3000, 4000, 5000, 6000, 8000, 10000, 15000, 20000, 25000, 30000, 40000, 56000, 60000, 75000, 100000, 250000 ohms.

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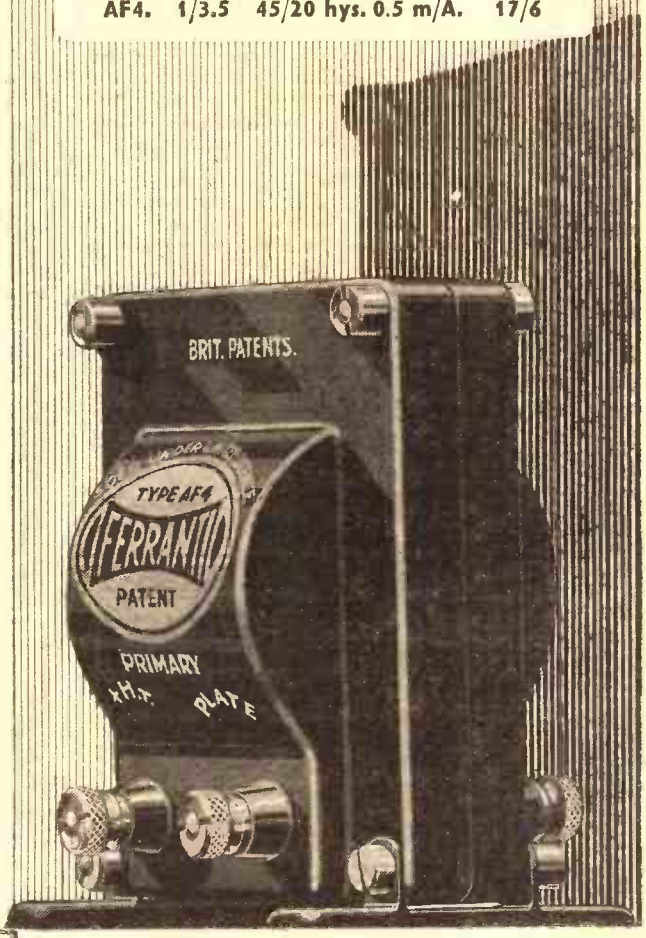
'TRANSFORMING' RADIO HISTORY

As long ago as 1925 Ferranti produced an Audio-Frequency Transformer so outstandingly good that it superseded all others, the world over. Thousands of Radio enthusiasts are to-day achieving excellent reproduction with sets incorporating a Ferranti Transformer bought over nine years ago. These Transformers were so good, and so advanced in design that they still hold their own, and are in steady demand to-day. Where else can such transformers be found? Their supremacy has been proved beyond question — even in the Tropics; in ship Radio installations, and by engineers everywhere where good and lasting qualities are essential.

The AF4 Transformer illustrated was the 3rd type built by Ferranti and is still in demand all over the world.

Type	Ratio	Inductance	Price
AF4.	**1/3.5**	**45/20 hys. 0.5 m/A.**	**17/6**



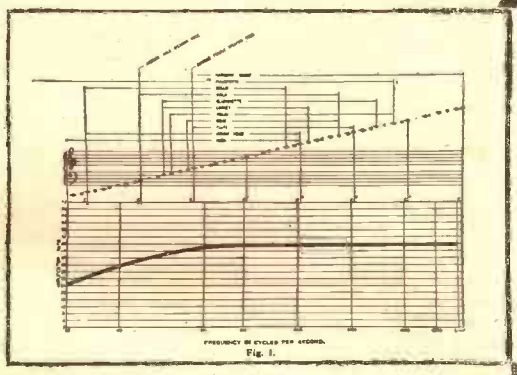


Fig. 1.

Type	Ratio	Inductance	Price
AF3	1/3.5	220/60 hys. 0.6 m/A.	**25/-**
,, 5	1/3.5	260/80 hys. 0.10 m/A.	**30/-**
,, 6	1/7	85/50 hys. 0.6 m/A.	**30/-**
,, 7	1/1.75	400/120 hys. 0.8 m/A.	**30/-**
,, 8	1/3.5	45/20 hys. 0.6 m/A.	**11/6**
,, 10	1/3	35/20 hys. 0.6 m/A.	**8/6**

Every Ferranti Transformer is guaranteed to give a performance within 5% of the standard published curve. Ferranti are the only Transformers so guaranteed.

FERRANTI LTD. HOLLINWOOD, Lancashire
London: Bush House, Aldwych, W.C.2

FERRANTI
A.F. TRANSFORMERS

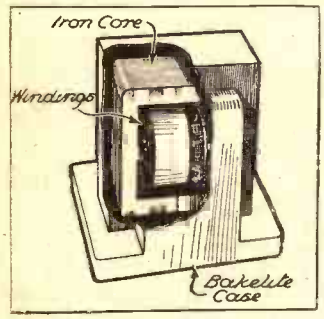
Special Beginners' Supplement—Page 2.

Either the turns on the primary can be reduced or those on the secondary increased.

The latter course is limited in its application because, as the turns are increased, so is the self-capacity of the winding increased. Capacity at this point is to be avoided like the plague, for it tends to by-pass the higher frequencies.

The turns on the primary, on the other hand, must be maintained above a certain value, or the inductance of this winding will fall below a good working figure. When attempts have been made to obtain higher ratios by this method being taken too far a serious lack of bass is to be noticed.

INSIDE THE CASE



A sectionalised diagram of a typical L.F. transformer showing the internal arrangement.

But apart from these drawbacks, which might conceivably be overcome by skilful design, to a considerable extent at least, it has to be borne in mind that a transformer does not work alone. Its functioning depends upon the resistances imposed upon its primary and secondary windings by the external circuit.

In actual practice some power is always taken from the secondary, and it can be accepted as a fact that the external primary and secondary resistances determine a turns ratio which will produce the maximum voltage step-up.

Maximum Gain.

For conditions of maximum amplification gain the L.F. transformer can be regarded as an impedance adjuster between two circuits. This is to be seen in the following expression:

The maximum voltage is developed across the secondary winding when the turns ratio squared equals the secondary resistance divided by the primary resistance. (It must be remembered that these resistances are external-circuit resistances.)

The primary resistance is, of course, the plate-circuit impedance of the preceding valve, and the secondary resistance is that of the grid-filament circuit of the valve into which the transformer feeds.

The core of an L.F. transformer must be laminated so that eddy currents are minimised, and it must be of sufficient size to avoid *saturation* at the currents normally passed.

Saturation is reached when further current increases fail to increase the flux density.

When it is anticipated that more current will be present than the transformer can carry without saturation, then the "shunt-feed" method of applying the high tension should be adopted.

In shunt feeding or parallel feeding, as it is often termed, the H.T. is taken to the anode of the valve through a resistance, while the L.F. impulses are conveyed to the primary of the transformer by means of a series fixed condenser.

The L.F. transformer is thus isolated from the D.C. H.T. flow.

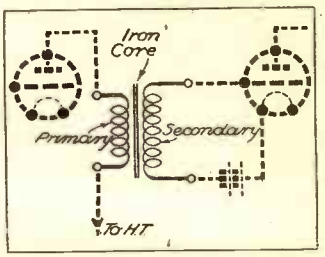
This method of connection is frequently advisable with the type of L.F. transformer embodying a high-permeability nickel-iron core.

Special Cores.

The purpose of using these special nickel-alloy cores is to achieve high primary inductances (100 henries is a good figure here) with a relatively small expense for wire. It will be appreciated that the inductance of any coil depends upon the number of turns and the permeability of its core.

The reduction of the number of turns of wire is accompanied by a decrease of self-capacity, and thus it is that these "nickel"

FOR COUPLING



Low-frequency transformers are used in most receiving circuits for coupling the detector and L.F. valves.

transformers achieve excellent responses, their characteristic curves often showing up well to six, seven, eight thousand and more cycles.

It is this type of transformer that is used in the "L.F. coupling units" that are offered as alternatives to ordinary L.F. transformers. These units comprise the necessary components for parallel-feed transformer coupling.

RADIO SUMS SIMPLIFIED

The figures and formulæ used in radio are by no means dryasdust mathematics, and this essentially practical explanation of logarithms is nothing if not fascinating.

LAST week we introduced you to a particularly useful method of simplified multiplication and division called logarithms. When you read through this brief introduction you may have wondered if it was all as simple as you were being led to suppose.

Don't let the preliminaries put you off. It is these that are the most tiring part. A knowledge of how to use log. tables will save you many weary hours of work, and will also largely eliminate those irritating slips that we are all liable to make when we are tackling cumbersome arithmetical sums.

Logs. were evolved with the idea of saving trouble—for practical non-mathematical people who don't want to be bothered with the complications met with in working out long decimal sums or in finding squares and square roots.

And they certainly achieve their purpose. For example, suppose you had to multiply two decimals like these together—68·12 and 9·827. It probably wouldn't appeal to you at all.

Perhaps the gentleman who invented logs. often had sums of that type to do, and so in desperation evolved his system to save himself time and trouble.

You see, if you can use logarithms you merely look up the two numbers in some log. tables. Then you add the logs. of the two numbers together, de-log. them by running your eye down another table and you have the answer you require.

If you had to divide your two numbers you would look up their logs., subtract one from the other, look up the anti-log. (this is what we called de-logging before) and there you are.

Now, going back to last week's article, you will remember that we said that 2 was the logarithm of a 100 to the base 10. Also that the base 10 was the only one we need consider as far as ordinary arithmetical sums are concerned.

Four-Figure Tables.

This particular system, called *Common Logarithms*, is available in tabular form for a few pence, and for most purposes the four-figure tables are all that are required. Tables of seven-figure logs. are not really necessary unless a very high degree of accuracy is needed.

By next week we shall assume that you have access to a set of tables so that we can refer to them and show you exactly how to read them. The thousands of readers who have "The Manual of Modern Radio" will find suitable tables on pages 316-319.

Bearing in mind that the log. of 100 to the base 10 is 2, we see that the logarithm of any number is the power to which the index must be raised to give the number. That is to say, if $\log_{10} 100 = 2$, then $100 = 10^2$. (We have already dealt with the question of powers in previous articles.) So we can write down various powers of ten as follows:

$10 = 10^1$, $100 = 10^2$, $1{,}000 = 10^3$, $10{,}000 = 10^4$, $100{,}000 = 10^5$, $1{,}000{,}000 = 10^6$ and so on.

And the logs. to the base 10 of these numbers are:

Number	Log.
10	1
100	2
1,000	3
10,000	4
100,000	5
1,000,000	6

You will notice that the logs. of numbers above 10 are greater than 1.

Now there are two terms which are freely used in connection with logs., viz. *Characteristic* and *Mantissa*.

When you look up a log. table it is *always* the Mantissa you find. The Mantissa is the decimal part of the log.

Take the number 402. If we look up some log. tables we find the number 6042 (we shall explain the tables in detail later.)

This is the Mantissa, and the log. is not complete until we have added the Characteristic. But the Mantissa is *part* of the log., viz. the decimal part.

We know that the log. of 402 must be greater than 1 because the log. of 10 is 1 and of 100 is 2. But 402 is less than 1,000, hence its log. cannot be as much as 3. Therefore it must be 2 decimal something or other.

The Characteristic.

Actually it is 2·6042, i.e., Log. 402 = 2·6042. Do you see what we have done? We have taken the Mantissa from the tables and then put the figure 2 in front of the decimal point. The figure 2 is called the Characteristic, and is the whole number part of the logarithm, whereas the Mantissa is merely the decimal part. You have to supply the Characteristic yourself, and it is found by this rule:

The Characteristic of a logarithm of a number greater than 1 is positive, and is 1 less than the number of figures in the whole number part of the number.

This may sound rather a mouthful, but it is simple enough if a few examples are taken. For instance, the Characteristic of 35·27 is 1 (35 is the whole number part), of 247·6 it is 2, and of 6557 is 3.

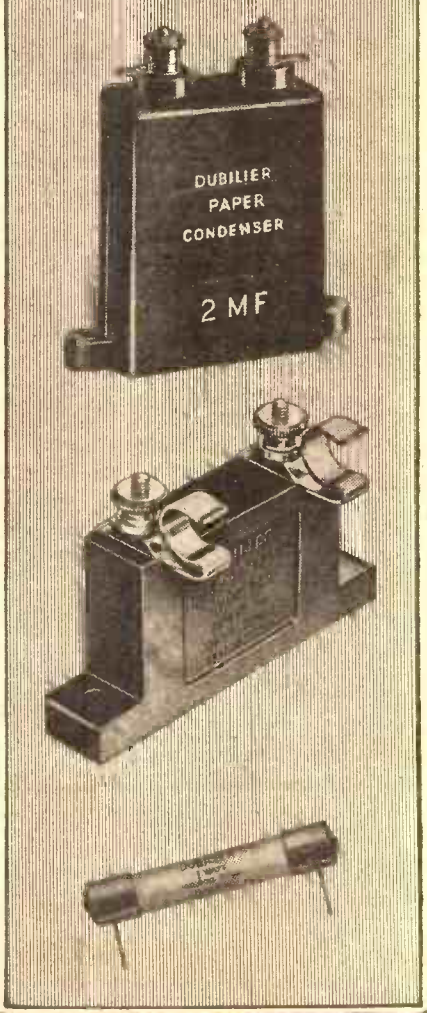
You can easily prove this if you remember what we said previously about the logs. of 10, 100, 1,000, etc.

DUBILIER

CONDENSERS & RESISTANCES

EXCLUSIVELY SPECIFIED *for the*

"BIFOCAL THREE"



The "Bifocal Three" incorporates an entirely new principle of radio construction, but like all previous successful circuit designs it incorporates Dubilier Condensers and Resistances for dependability. All progressive designers know from experience that they have no equal for reliability. Constructors should insist on Dubilier—they are then assured of the finest possible results.

BRITISH MADE DUBILIER

BRITISH MADE DUBILIER

The following are the Dubilier Condensers and Resistances specified for the "Bifocal Three":

1 Dubilier Type B.B. Condenser 2 mfd. ..	3/6 each
2 Dubilier Type 620 Condensers ·0002 mfd.	1/3 each
1 Dubilier Metallised Resistance 100,000 ohms one watt type	1/- each
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DUBILIER CONDENSER CO. (1925) LTD., Ducon Works, Victoria Road, North Acton, London, W.3.

TESTED AND FOUND-?

Being leaves from the Technical Editor's Notebook

THE VARLEY "BIFOCAL" COIL

IN the present state of the radio art entirely new developments are extremely rare events. There are plenty of new components and accessories and even new circuits issued during the course of the months, but very few of these embody anything much more than detail improvements on current practice.

The Varley "Bifocal" coil is different; this device really is fundamentally original. Moreover, its originality has purpose and value.

I hate to be dogmatic, but I feel pretty safe in saying that here we have one of the greatest departures in coil design and construction since the days when the "basket" and "honeycomb" attempted to rule the radio waves.

You see, this Varley "Bifocal" does not merely do in a different way something that any other existing coil can already accomplish. Without the shadow of doubt it is the only self-focusing coil that has ever been produced.

The very term "self-focusing" is quite new, and the fact that it has been found necessary to invent a term to describe the function of the coil is clear proof of its originality.

The ordinary coil is a "static" kind of article. It contributes lump inductance to a circuit and an H.F. energy-entry of a fixed degree, or, perhaps, of a series of crudely spaced degrees arbitrarily determined by tappings.

Adjustable to all Conditions.

A compromise between selectivity and power, then, has to be made by means of ancillary apparatus.

With the "Bifocal," on the other hand, the coil itself is smoothly adjustable to the conditions. In other words, you "focus" it so that only that thin slice of the H.F. spectrum representing a desired programme has the powers of magnification concentrated on it.

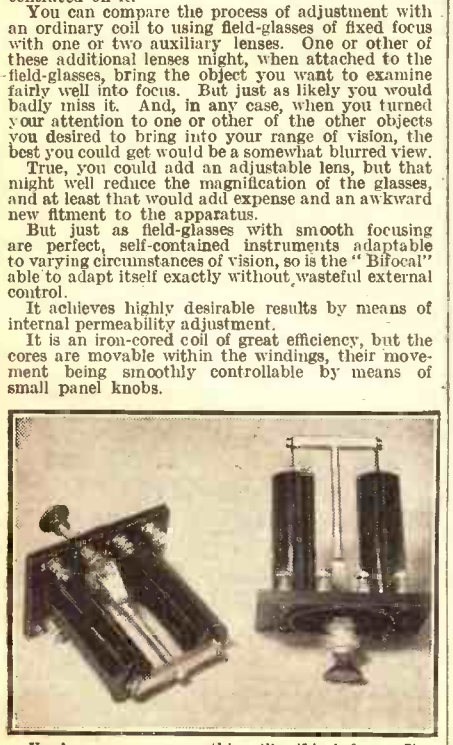
You can compare the process of adjustment with an ordinary coil to using field-glasses of fixed focus with one or two auxiliary lenses. One or other of these additional lenses might, when attached to the field-glasses, bring the object you want to examine fairly well into focus. But just as likely you would badly miss it. And, in any case, when you turned your attention to one or other of the other objects you desired to bring into your range of vision, the best you could get would be a somewhat blurred view.

True, you could add an adjustable lens, but that might well reduce the magnification of the glasses, and at least that would add expense and an awkward new fitment to the apparatus.

But just as field-glasses with smooth focusing are perfect, self-contained instruments adaptable to varying circumstances of vision, so is the "Bifocal" able to adapt itself exactly without wasteful external control.

It achieves highly desirable results by means of internal permeability adjustment.

It is an iron-cored coil of great efficiency, but the cores are movable within the windings, their movement being smoothly controllable by means of small panel knobs.



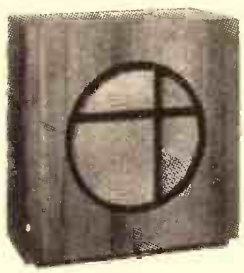
You've never seen anything like this before. It is a photograph of a pair of the new Varley "Bifocal" coils—the greatest departure in coil design for a decade.

The coil is divided into two sections—medium and long wave.

Each winding has an input tap, and the electrical position of this tap is varied up or down by shifting the position of the iron core relative to this tap.

I will explain this in detail as simply as I can. Supposing the tap were exactly centrally placed in the winding. If the core were also dead central the inductance above the tap would be the same as that below the tap, and the tap would be in truth a "centre-tap."

But supposing the core is moved so that the greater part of its bulk lies above the tap. Then the top part of the winding will have a greater inductance than the bottom part. In effect you have moved the tap to a lower part of the coil.



In addition to the modern and utilitarian cabinet seen here, the new R & A reproducer is completely versatile in that it can be used with any type of set, home made or commercial, by virtue of the unique range of matching adjustments.

In actual fact the disposition of the windings, cores and taps is not quite such a straightforward business as this, but I trust you will now understand the fundamental idea of the new principle.

The principle of "self-focusing" does not end here, though. By skilful design the permeability shift is made to compensate for the consequent varying input loads.

Therefore, to all intents and purposes, the tuning does not change. Further, the reaction winding is so disposed that reaction, too, remains constant!

The triumphant result is that the "focusing," which is accomplished merely by pushing the little knob in and out, is cleanly separated from the other controls of the set—is, in fact, independent of them.

Now, some of you may be thinking that this all sounds most interesting, but are waiting for me to say what the coil does when it is put to test in the hard practice of the modern ether.

Great Efficiency and Selectivity.

Well, I have no hesitation in saying that the Varley "Bifocal" acts up to the glowing promises of its ingenious principles.

It provides a greater relative efficiency for a given degree of selectivity than any other arrangement we have tried in the research department.

With two of them in an S.G. det. circuit a discriminate "focusing" throws an entirely new light on what can be done with simple apparatus of inspired design.

We certainly owe a great debt to Messrs. Varley for taking us this big step forward, and the least all enthusiastic constructors can do is to write to them at 103, Kingsway, London, W.C., for any literature they may have about their "Bifocal" coil and see what they themselves have to say about it in their usual explicit and modest manner.

THE R & A "MULTEX" REPRODUCER

During the course of the next season a powerful campaign is to be waged. Run by a group of manufacturers, its purpose will be to educate the public to appreciate the virtues of extension loudspeakers.

It seems extraordinary to me that the public should need this, for, in my view, the house that has only one loudspeaker more or less permanently fixed in one room is only partially equipped with radio.

It may be suggested that in many homes only one room is "lived in," and in that one room radio is both listened to and used as a pleasant background to meals, and so on.

But what about the kitchen (or scullery)? Why should the lady of the house have to miss tit-bits during what time she has to repair to her culinary quarters?

Where separate rooms are employed for eating and lounging, at least two loudspeakers appear to me to be essential.

At the forefront of the extension-speaker campaign will doubtless be Reproducers and Amplifiers, Ltd., of Frederick Street, Wolverhampton, for already they have produced an excellent R & A Reproducer, which has been mainly designed for use in this way.

It is styled the "Multex," and is claimed to be the only universal all-purpose loudspeaker, or, I should say, *reproducer*, for R & A do not use the other word more than they can possibly help. For which, by the way, I don't blame them, for "loudspeaker" is not a pretty word and is definitely misleading in its modern application.

The "Multex" Reproducer is completely versatile, and it can be used with any type of set, home made or commercial.

It achieves its extraordinary adaptability by virtue of its unique range of "matching" adjustments. No less than twenty-seven different conditions of load can be adjusted for merely by varying the transformer-plug connections.

Ordinary high and low ratios are available, together with exact adjustments for Push-Pull, Q.P.P. or Class B.

A Feature that is Invaluable.

And the system goes further than just matching in direct connections. The special feature is that the reproducer can be connected additionally to one already in use, either near to the set or at a distance, and the correct conditions still be maintained.

This is, of course, a very important point, and brings the extension-speaker idea into the realms of exact engineering instead of it being, as is too often the case, a hit-or-miss kind of affair.

It is also to be noted that provision is made for the volume balance of the "Multex" and the existing speaker by adjustment of the transformer tappings, and this is a feature that will be found invaluable in practice.

The "Multex" is a permanent-magnet moving-coil instrument, and it costs only 45s., complete in a fine walnut cabinet. One of the prettiest cabinets I have seen.

It gives first-class results, and must not be thought of as a "second-line" speaker. It can hold its own with any others, even at higher price levels.

I wish I could tell you more about it, for it is a most interesting instrument; but for other details I shall have to refer you to the literature published by the makers from the above address.

THE LINK BETWEEN

Jottings of interest to buyers

By G. T. KELSEY.

HAVE you ever seen a set—fo-cused? Well, I have! And, like the sentiments expressed in the popular song from which my parody is taken, this, too, was a dream in reality.

It takes a lot these days to arouse my enthusiasm when it comes to something new in the world of radio; for the fact of the matter is that we have had so many new developments of one kind or another during the last twelve months that one is apt to become perhaps a trifle *blasé*. But as for the "Bifocal Three"—well, I'm "focusing" crazy! It really is a most intriguing business, and from my own personal tests I am convinced that the principle of focused radio is destined to play a very big part in the future of home-constructor designs.

I visualise the time, not very far distant, when "Can you focus?" will be a radio password even more popular than the now extinct "Can you Yo-Yo?" And that swept the country, in all conscience! It's easy enough to be eulogistic in print, but just you wait and see!

* * *

It is part of my job (and, in this respect, a very pleasant one it is, too) to provide weekly notes of interest to buyers. That being the case, to do justice to my own personal opinions of the "Bifocal Three," I shouldn't be overdoing it if I devoted the whole of my notes this week to the reasons why *you* should build it. But that is hardly necessary. It is indisputably a fact that no greater team of technicians and experts has ever co-operated in the design of a single set, and that alone carries greater significance than anything I might feel inclined to add.

The main thing to remember is that this is an "industry" set, and as such it has been designed specifically to meet the exacting requirements of modern conditions. The wavelength plan which was evolved at Lucerne may, or may not, be regarded as a success, but it is patently obvious in the design of the "Bifocal" that the manufacturers concerned have made a commendable attempt to answer for the receiving side of the question.

If you follow their lead you will at least have the satisfaction of knowing that the next move is with

(*Continued on page* 1095.)

The Truth About SOUND-ON-FILM

Will the advantages claimed for sound-on-film recording stand the searchlight of close investigation? As the system stands at present it appears doubtful whether these advantages really exist, judging by the reasoning contained in this article

By G. P. KENDALL, B.Sc.

I WONDER if I shall ever grow out of the desire to heave (metaphorical) bricks into other people's (technical) glass houses! I doubt it, for it is not really the result of a spirit of mere mischief, but comes from the annoyance I always feel whenever I see someone trying, however innocently, to mislead my old friends, the radio enthusiasts of this country.

Better Than Disc Records?

The fact is that I have had my eye on a particularly shiny glass house for some time, and I can no longer resist the temptation. I hope the resulting crash will be a good one, but that nobody will be hurt!

The glass edifice in question consists in a little agitation which I have noticed in certain quarters in favour of the immediate development of the "sound-on-film" system for electric gramophone purposes. I see that it is being suggested that this system is so greatly superior to the present method that it must inevitably supplant the disc altogether as soon as it is made available to the general public, and it is this that has made me pick up my trusty brick.

Before I throw it I ought perhaps just to refresh the reader's memory as to the essential features of the "S.-O.-F." system. Briefly, it works this way: the sound record or "track" is in the form of light and dark markings on a long narrow strip of photographic film, and this film is made to run through an apparatus in which a tiny pencil of light passes through the "sound track" and then falls on a photo-electric cell.

The "Long-Playing" Characteristic.

The markings of the sound track thus cause variations in the intensity of the light falling on the cell, and so produce variations in the current flowing through the latter. These current fluctuations are fed to an amplifier and magnified up in just the usual way.

Now, I fully appreciate the great many advantages of the sound-on-film system, especially its "long-playing" characteristic, which seems to me the most important of all its attractions; imagine the joy of using a reproducer which would run for perhaps twenty minutes on a single loading! It would do this, remember, with none of the pauses and mechanical sounds of the self-changing disc gramophone, and needle-changing would become a nuisance of the past.

Would It Often Break?

It so happens, however, that I have had considerable practical experience of the use of cinematograph film, and I very much wonder whether those who clamour for the film gramophone would be quite so keen if they were equally familiar with that at times exasperating material!

Do they realise, for example, that it must be kept under proper conditions, otherwise it becomes dry and brittle and breaks easily when running? Such breakages are always liable to occur, although I agree that they are rare with correctly treated film.

Splicing Not So Easy.

The cinematographer, of course, thinks nothing of them. He just gets out a little gadget and proceeds to make what he calls a "splice," an operation which may not take him more than a minute to complete.

To make a really good splice, which will run smoothly through the apparatus and be permanent, however, is quite a trick, and a little practice is needed before it can be done with certainty.

Again, loading a sound-film reproducer is necessarily less simple than placing the pick-up on a disc record. The film must be threaded accurately into the mechanism so that its perforations are engaged by the teeth of one or more "sprocket wheels," and the end attached to the "take-up" reel into which it is to run.

After running through, the film must be wound back on to the original reel, ready for use on the next occasion, and although this is simple enough it is something extra as compared with the disc record. The film is delicate, too, and must be handled with considerable care in the course of these operations.

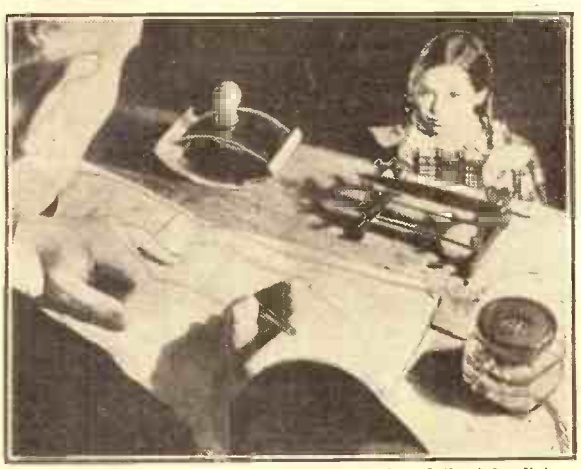
The system is definitely more expensive than the disc. The optical devices must be made to very high standards of precision, and the output of the present types of photo-electric cell is very small, so that a very powerful amplifier is needed.

Another Exaggeration.

The long-playing characteristic is easily exaggerated, too. For real quality of reproduction the minimum speed limit is about 90 feet a minute, and there is a definite limit to the amount of film which can be placed on a single reel. Even a thousand-foot film runs for only about eleven minutes at this speed, and it is much heavier and more bulky than equivalent disc records.

And now do you think sound-on-film is so vastly better than the simple and practical disc system?

A USE FOR LONG RECORDINGS



The scene depicted here is in a German court, and the inkwell is actually a disguised microphone for recording evidence of witnesses. This is one instance in which the "non-stop" property of sound-on-film recording would be of considerable advantage.

THOSE PUZZLING RATTLES

FAINT little rattles, occurring only on heavy passages of music, can be very difficult to trace. But this is not really surprising, since they are usually caused by the most unexpected of components.

As a rule, the kind of set in which this trouble is experienced is of the all-in type with incorporated loudspeaker. And the cause is often the sound from the back of the speaker causing some small item to rattle.

One looks first of all for loose parts on the loudspeaker itself, or a loose terminal—and finding none is somewhat stumped. But there *are* other things to suspect.

Try the Valves.

Tap the valves one after the other and see if the rattle is produced. A small piece of loose glass in the bulb is sometimes the culprit.

Even the spring pig-tails on solid-diclectric condensers may dither and cause a high-pitched burr. A thick smear of "Vaseline" will generally stop the dither, and will not cause leakage. **A. S. C.**

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

THE "PILOT" THAT HAD TO BE DROPPED.

"Some few months ago I built up a 'Cosmic 3 Star' set, and I wish to thank you for producing such a thundering good circuit. The selectivity is fine using the moderator; in fact, I have yet to hear a commercial set to equal mine.

"Previously, I had a cone speaker, but by saving up the odd coppers have at last sported a Magnavox moving coil. I now have *the* goods, and have just completed making a cabinet to house everything.

"(Here I want to thank your contributor of a recent issue for information as to the posh finish.)

"There is just one query which certainly puzzles me. In order to give a finish to my set I wired up a pea lamp in series with the L.T. switch from accumulator in order to light the dial (unfortunately the 'duotone' condenser dial is of steel). When I switched on, nice little light, but no sound came from the speaker. Not accounting for the trouble, I overhauled everything.

"As a last effort I shorted the lamp, and at once everything came through O.K.

"Can you tell me the reason? Does the lamp act as a resistance?

"'P.W.' is my main source of wireless knowledge, but I do not remember ever reading about a similar occurrence to the above."

So writes Mr. C. H. Cox, of 37, Kingswood Chase, Leigh-on-Sea. And as other readers have wondered about similar experiences when fitting "pilot-lamps," we give below some details about this subject.

First, to deal with this particular case, we must answer the questions raised by Mr. Cox.

What was the reason his set refused to work? Was the lamp acting as a resistance?

Experienced readers will recognise this latter as a correct diagnosis. Undoubtedly the lamp *was* acting as a resistance, and thus prevented the set from working.

It would have been all right but for a mistake in wiring. For in all ordinary cases a pilot lamp should not be wired *in series*, as was done in this instance, but it should be *in parallel*.

If it is connected as described in the above letter, all the current to the valves has to flow through the lamp, which is of comparatively high resistance. Consequently, it limits the current flowing, and the valves are "starved." That is why the set would not work until the lamp was shorted.

The correct connections would have been to leave the filament wiring and connections to the accumulator exactly as before, but to place the lampholder connections "across" the filament terminals of one of the valve holders.

One side of the lamp would then have been joined direct to L.T.−, and the other side to L.T.+, via the on-off switch.

This leaves the original path for current from the accumulator to each valve holder. But it provides also a connection from L.T.− to L.T.+ via the lamp, so whilst the current for the valves flows through the filaments as usual, a certain amount of additional current takes the parallel path and lights the lamp.

The working of the set is not then affected, except that the accumulator will not last quite as long without recharging, because of the extra current taken from it.

The *amount* of this extra current taken may well be important. In the case of the mains set it does not matter at all, even if the lamp is a comparatively powerful one, because at public-supply rates the cost is quite negligible; but when the light comes from an L.T. battery the lamp should be one of the low-consumption type, or battery-charging will be more costly and frequent than before.

Just how much difference it will make can be worked out for any individual case by Ohm's Law, on the principles outlined in the "P.W." Beginners' Supplement.

In this particular case, for example, the current drawn from the accumulator is at present probably about ·4 amp., made up of ·1 for the first valve, ·1 for the second, and ·2 for the power valve—a total of ·4 amp., since the respective currents must be added together to find the total current consumption.

If a low-consumption "pilot" is used, say one of the ·06-amp. type, this figure must be added to the current consumption, which then rises to ·46 amp. This, it will be seen, is approximately one-seventh greater than before, so if the accumulator formerly lasted a fortnight between charges it will now last only twelve days: or if a week, only six days, and so on.

A final interesting point is—why did the lamp glow when the set failed to work?

The reason is that of the 2 volts available from the L.T.B., only about 1/100th of a volt was across the filaments, the rest of the voltage being "dropped" across the comparatively high resistance of the lamp. Students of our Beginners' Supplement may be interested enough to work out (from Ohm's Law, and that of resistances in parallel, and in series) how this figure of approximately 1/100th volt is arrived at from the data given.

MECHANICAL COUPLING

FOR BETTER RADIO

With the prevalent use of ganged switches, linked potentiometers, etc., it occasionally happens that hard-to-find faults are traceable to defective mechanical coupling.

* * *

When the fault is mechanical, such as "slip," it can generally be detected by careful inspection. But sometimes the fault is electrical.

* * *

In some very powerful receivers, for instance, feedback is caused unless long switch rods, etc., are "earthed." And sometimes crackling noises are traced to long coupling links in which there is "give" between adjacent metal surfaces.

FAULTS THAT MAKE YOU FORGET YOUR NEW YEAR RESOLUTIONS!

"P.W." is proud of the way in which its readers try to help one another by recounting unusual faults, etc., in letters to the Editor, so that when "the other fellow" gets a similar fault he will know what to look for. We have to thank Mr. F. W. Pearce, of 16, Trumpington Road, Forest Gate, for the following interesting account.

"Dear Sir,—As you seem to make a point of dealing, in your 'Radiotorial' columns, with those faults that make an otherwise perfectly respectable person forget all his new year's resolutions, I hasten to let you have my experience in the hope that it may benefit some other reader.

"The culprit was one of the Catkin valves—a pentode, as a matter of fact—and was being used in the 'Eckersley Three A.C.' model.

Well, I made a good job of the set, carefully soldering all the connections and finally arrived at the stage when one carefully inserts the valves, switches on, and sits back to listen.

"Well, after rotating the tuning knob, one of the London stations came in at full strength, and then was gone again!

"S'funny, thought I, and had another go. As soon as I touched the set it started again. Aha! a loose connection!

"Carefully listening, I diagnosed a break in the grid circuit, as at periods when the set did not suddenly break into song, the music could be heard at about 1,000 miles off. Well, I went over the whole of the set carefully without finding it.

"Then I began to wish that I had a milliammeter. I changed the valve holders, and, in fact, did everything that I could to try and make the set hold the station for a few minutes.

"A touch to any of the valves either brought the station in, or if it was in, knocked it out again.

"Saturday this happened, and came Tuesday with me still patiently looking. Tuesday night, with a do-or-die attitude, I started again.

"After half an hour patiently waggling the wires, I suddenly found that by holding the anode of the pentode (with a handkerchief) the signal 'stayed put.'

"A little further careful investigation showed that there was a slight amount of give in the rubber seating between the glass seal and the base, and when the anode was held it just pressed down a trifle.

"Yes! It was just a broken grid connection between the glass seal and the base.

And now a word of commendation concerning the set. The station-getting, and quality on a Rola mains-energised M.C. speaker are simply great, and I think when I have a good valve, I am going to be very much in Mr. Eckersley's debt.

"P.S.—I am going to buy a milliammeter now."

THE MICROPHONIC VALVE AND "SOUND AND RADIO WAVES."

Mr. F. W. Bushell, of 91, Olney Street, Walton, Liverpool 4, raises the following interesting query, which may have puzzled other readers also. He says:

"I have just been reading Sir Oliver Lodge's article in 'P.W.' on 'Sound and Radio Waves.' One part reads, 'A vibrating body in a vacuum cannot be heard.'

(*Continued on page* 1092.)

STATION IDENTIFICATION

STUTTGART

Under Germany's recently adopted "Regional" Scheme the Stuttgart station was moved from the city, and a high-power transmitter was erected at Muhlacker, near by, to serve Stuttgart. Its power is 100 kilowatts.

* * *

Until last January the wavelength was very close to that of London Regional, but under the Lucerne Plan Stuttgart was allotted the comparatively high wavelength of 522·6 metres.

* * *

The best way to identify it is to tune to Athlone, and then "come down" about one degree on the dial, Stuttgart being the next station below Athlone. It is therefore immediately above the Riga dial-reading, which is just a little above Vienna's.

* * *

The announcements are in German, and the programme is relayed on 251 metres by Freiburg-im-Breisgau.

ECONOMY

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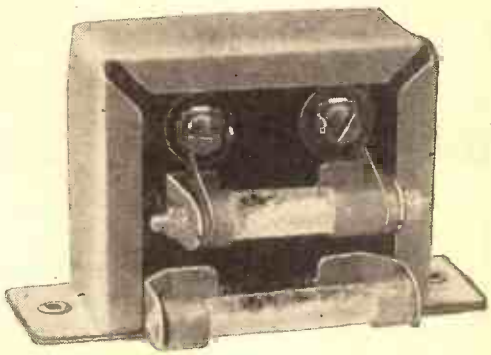

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The "Autocontrola" is the only unit of its kind which will automatically control battery consumption. This battery saving device has been designed specially to operate in the "Bifocal Three," and its inclusion means practically halved running costs to you. To obviate any possible risk of faulty contacts in this sensitive set, Benjamin valveholders with spring-grip self-cleaning sockets are also specified.

Every detail of this magnificent set has been carefully planned, every component has been chosen because the designers from their great experience know it to be the best of its kind; all *you* have to do is to follow these recommendations and your personal efforts have the backing of the nine leading Radio Manufacturers in the country.

A list of the Benjamin parts you will require is given below.

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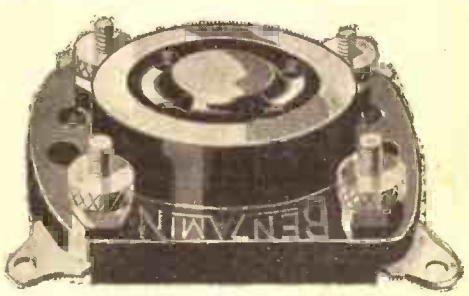
ONE BATTERY SWITCH - - - - -	9d.



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RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 1090.)

"I am puzzled to know how a vibrating filament in a microphonic valve gives the high-pitched whistle in the loudspeaker when the offending filament is vibrating in a vacuum tube."

This is a trifle complicated by comparison with an ordinary experimental case, because although it is the vibrating electrodes in the valve that set up the howl, the actual sound comes not from there, but from the loudspeaker.

Thus, the "vibrating body" which is heard is not anything inside the valve, but the vibrating diaphragm of the loudspeaker.

(As a matter of fact, the electrode vibrations are so minute that even if they took place in air the keenest ears in the world would be unable to detect them. But inside the valve such vibrations have the same effect as voltage changes on the grid, at an audible frequency, and so they affect the loudspeaker just as low-frequency voltage changes would if applied to the grid in the ordinary way.)

To prove that "a vibrating body in a vacuum cannot be heard," as applied to a microphonic valve howl, it would be necessary to *enclose the loudspeaker in a vacuum*. If this is done no sound reaches the ear, because there is no medium through which the sound waves can travel, as explained by Sir Oliver Lodge in the article in our January 27th issue.

WHICH IS BETTER FOR A ONE-VALVER—A STAGE OF H.F. OR A STAGE OF L.F.?

I. L. (Forest, Pontardulais, Swansea).—"I read and enjoy every bit of "P.W." starting with 'Ariel's' philosophic drollery right through to Dr. Roberts' valuable articles. I am not yet a short-wave fan, but I read W. L. S.'s page with interest.

"By the way, 'Ariel' mentioned some time ago that he would like to know what the Welsh was for the following radio terms. He asked for it, so I have been busy, and here they are: 'Side-band splash,' Poeri llain ochr; 'Quiescent push-pull,' Gwth-tynfa llonydd; 'Circuit,' Cylchdaith.

"Make him remove his dentures (if any), then let him pronounce them and watch him writhe! They are free-and-easy translations and not authoritative, but I have done my best—I suppose my worst from 'Ariel's' point of view. So when he has recovered his breath and replaced his tonsils, apologise for me!

"I should now like to ask a question which I think is of general interest. If you had a one-valve detector set, which would bestow most benefits—a stage of H.F. or a stage of L.F. amplification?"

FAULT FINDING

If you are up against a radio problem remember that our Technical Query Department is thoroughly equipped to assist our readers, and offers you its unrivalled service.

Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do. On receipt of this an application Form will be sent to you post free immediately. This application will place you under no obligation whatever, but, having the form, you will know exactly what information we require to have before us in order to solve your problems.

LONDON READERS PLEASE NOTE: Inquiries should NOT be made by phone or in person at Fleetway House or Tallis House.

We can only hope that "Ariel" finds it easier to pronounce your posers than it is to give a definite technical ruling upon which is the better addition to a one-valver—the stage of high- or of low-frequency amplification.

The two are so different that comparison is hardly possible. And which would be better in any given circumstances depends entirely upon what those circumstances are.

If, for example, the owner of the one-valve set was keen upon long-distance reception, and had no objection to wearing telephones when listening, there is no doubt that the stage of high-frequency amplification would be the better proposition.

A good H.F. amplifying stage preceding the detector ensures that even when using a poor aerial the set owner will hear dozens of stations at enjoyable strength.

If he has a good aerial he can count on a great many even in daylight, when reception is generally difficult, if not impossible, on a one-valver, except for the local station.

On the other hand, an H.F.-and-detector arrangement is no good for loudspeaker work, but this is often quite practicable with a detector-and-L.F. circuit if the aerial is not too far from a local station. So the L.F. stage is better when loudspeaker results are in question.

If it can be stated briefly, the difference between the two methods is that the stage of H.F. provides extra *range* and the stage of L.F. provides extra *power*.

Both statements need qualifying to some extent, but that is the prime difference which should be borne in mind when comparing the two methods of adding a valve.

HOW TO SWITCH OVER FOR GRAMOPHONE PICK-UP.

T. Y. (Partick).—"I want to fit a pick-up lead and switch to the set, to change over to gramophone, and I am told that a single-pole double-throw switch is necessary.

"Will one of the Bulgin S.86's do? And if so, what are the alterations necessary for this?"

With the type of switch named almost any set having one or more stages of low-frequency amplification can easily be converted to "pick-up" working.

When the detector valve holder is situated near the panel, you can mount the switch on the panel itself. But in sets where the detector valve holder has been placed near the back of the baseboard it is generally better to mount the pick-up switch on the terminal strip.

Alternatively, a baseboard bracket may be used for mounting, an extension rod protruding through the panel, then providing the necessary means of control.

The following are the wiring alterations:

First disconnect the lead or leads joined to the grid terminal of the detector valve holder, and connect instead to one of the "outer" terminals of the radiogram switch.

The centre terminal of this switch should then be connected to the grid terminal of the detector valve holder.

(*Continued on page* 1094.)

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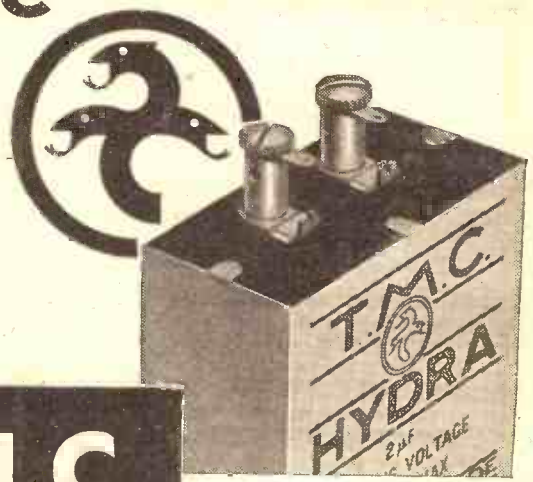

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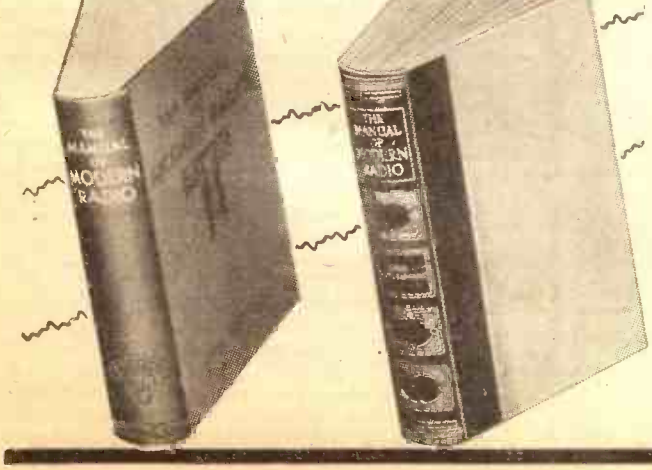

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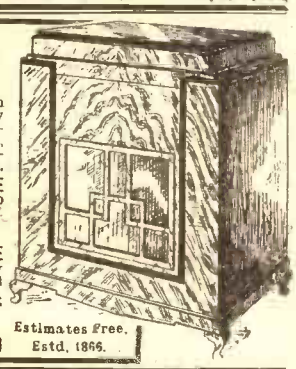

PLEASE be sure to mention "Popular Wireless" when communicating with Advertisers. Thanks!

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 1092.)

(It will now be seen that when the switch makes contact, it restores the connections for radio exactly as they were before the switch was there.)

Now connect one of the pick-up leads to the other "outer" terminal of the radiogram switch, and finally join the other pick-up lead to a 1½-volt grid-bias negative tapping.

The above is for a battery-run set, but the method can also be applied to a set using indirectly-heated (mains) valves and a leaky-grid type detector.

In such a case the lead connected from earth to the C terminal of the detector valve holder should be disconnected and joined to one terminal of a resistance (the value depends on the valve used), and to one terminal of a 2-mfd. condenser.

One of the pick-up leads goes to the radiogram switch, as in the first instance; but the other pick-up lead goes to the same terminals of the resistance and 2-mfd. condenser as the leads which formerly went to "C."

The vacant terminals of the 2-mfd. condenser and resistance should now be joined together, and to the C terminal of the detector valve holder.

Finally, disconnect the grid leak and join it between the G and C terminals of the detector valve holder.

If a volume-control potentiometer is to be used for radiogram working, the pick-up leads are attached to the respective outer terminals of this.

The centre (slider) terminal and one of the outer terminals then make the usual connections to the set, viz. slider to radiogram switch, one outer terminal to grid bias (in the case of the mains set, this latter means connecting the pick-up lead to the resistance and 2-mfd. condenser on the sides which are not connected to the C terminal of the detector valve holder.

WHERE HAS MUHLACKER GONE?

A. G. (Wood Green, N.).—"Before he put his power down, I used to get Muhlacker quite well at times. But since the Lucerne plan last month I have not heard this station.

"I should like to know whereabouts he is to be found now, as my grandfather used to live at Stuttgart and is always asking me to get Muhlacker for him to hear the Stuttgart announcements and music."

The Muhlacker-Stuttgart programme, formerly right "on top" of London Regional, is now on 522·6 metres.

This is right up near the top of the medium-wave dial and a little below half-way between Vienna and Budapest.

(Vienna is now on 506·8 metres, and Budapest on 549·5 metres.)

"DEATH AT BROADCASTING HOUSE"

A Novelty in Crime Stories.

THE writer of detective fiction is faced nowadays with a serious problem. Where is the murder to be placed? The library of the country house, the railway train, the deserted coppice have been exploited *ad nauseam*.

Messrs. Gielgud and Marvell have had the sense to realise the possibilities of their own "shop" as the background of sudden death. Nor have they neglected their opportunities in describing the technicalities of a "shop" whose detailed description cannot fail to interest every listener in the country. The wireless "fan" and the crime-novel "fan" alike should find this book absorbing.

The plot is ingenious. The writing is tolerable. There is characterisation—so often entirely neglected in similar books—and there are thrills. Clues are legitimately exposed, and the solution is a genuine surprise. No doubt, also, the malicious—in spite of the authors' denials—will get a lot of fun out of finding originals at Broadcasting House for several of the book's characters.

Amusing Plans and Illustrations.

There are some amusing studio plans and reproductions of such queer things as cast-sheets and panel groupings. There are also a few small slips, which it would be ungenerous to give away. But, in making the victim an actor in a radio play, have not the authors given too much rein to their natural feelings as producers? Many actors would read with pleasure of the sudden death of a producer at the dramatic-control panel. While listeners might easily prefer both. . . .

"Death at Broadcasting House" is published by Rich & Cowan, price 7s. 6d.

TELEVISION PROGRESS—"CARRYING" THE PICTURE

(*Continued from page* 1075.)

to the subsequent amplifying valves a phase change is introduced. Increasing light values produce a current impulse in one direction, whilst decreasing light values produce a current flow in the opposite direction. In other words, the curve B in Fig. 2 is equivalent in every respect to the final curve marked C.

This curve is the really important one, because it will be seen that parts of the picture of uniform brightness, e.g. from *c* to *d*, are now represented by no radiation, whilst the other portions are arranged more or less equally above and below the datum line. That is to say, parts of increasing light value are shown above the line, whilst parts of diminishing light value appear below the line.

Unheard by Broadcast Receiver.

But currents above and below the line are respectively 180° out of phase. They will therefore neutralise each other in any ordinary receiving circuit tuned to a 1,000-metre wavelength, because they have no time to "build up." As soon as one impulse is received it is nullified by the next impulse. For the same reason they cannot "shock excite" a broadcast receiver tuned to any other wavelength.

It can be anticipated that in any ordinary picture there will be as many increases of light intensity as decreases. That is to say, there will be as many positive waves as negative waves, and so the overall effect on the ordinary wireless receiver will be nil.

A television programme sent in this way will accordingly not interfere with broadcast reception, though it can be readily reproduced on a receiver designed to respond positively to all signal waves, irrespective of their phase.

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PIX INVISIBLE AERIAL

DOUBLE LENGTH 3/6

THE LISTENER'S NOTEBOOK

(*Continued from page* 1082.)

It was invigorating to hear young England (and Scotland) debating the pros and cons of disarmament. I was chiefly impressed with the oratory of Scotland's second speaker, though he had one very bad patch when he didn't seem to know whether he was talking about the Army, the Navy or the Air Force. That was early on in his speech. Once he had settled down he was sureness itself.

* * *

It was strange to hear Mabel Constanduros with a fresh partner. To my mind the act wasn't quite so good on that account. Anyhow, it did Michael Hogan a good turn. It proved how indispensable he is. I'm afraid we are inclined, in the case of these pairs of artistes, to underestimate the importance of one of them.

Quite often the "inferior" party, who is given no higher-sounding title than "partner," has a difficult job to perform. Feeding the comedian isn't all honey, especially as the laugh is always on the feeder himself.

THE LINK BETWEEN

(*Continued from page* 1088.)

the broadcasting authorities. Be wise—"Bifocalise," and you, on your part, will then have done everything possible to sort out the trouble from your end. And after that, what is left undone will be a matter for the next Wavelength Conference.

Telsen Price Reduction.

In the last issue of "P.W." we gave a complete test report of the new Telsen Model "474" all-mains receiver. I am glad to be able to pass on the news that a reduction has now been made in the price of this receiver.

The retail price of the "474" is now 9½ guineas, and the price of its "twin" brother, the Model "470," has been reduced to 9 guineas. Those of you who read the report last week will appreciate that the "474" at 9½ guineas is a most attractive proposition. But whether you read the report or not, it will be obvious that the price of 9½ guineas for a first-class all-electric set is extremely reasonable, to say the very least of it.

Radio at the B.I.F.

I am glad to note that several prominent firms are exhibiting at the British Industries Fair this year. Although, strictly speaking, the B.I.F. is a trade exhibition, the general public is admitted after 4 p.m. each day, and all day on Saturday, and if you are able to pay a visit to one of the centres the following information will be of interest to you:

At Olympia you will find Belling & Lee (Stand No. H.29), The British Broadcasting Corporation (Stands Nos. J.55 and H.73), British Radiophone (Stand No. H.48), A. F. Bulgin & Co., Ltd. (Stand No. H.35), E. K. Cole, Ltd. (Stand No. D.47), Dubilier Condenser Co., Ltd. (Stand No. H.20), Ever Ready Co. (G.B.) Ltd. (Stands Nos. H.38 and 39), Garrard Engineering & Manufacturing Co., Ltd. (Stand No. H.40), Vinces Dry Batteries, Ltd. (Stand No. H.44), and Wingrove and Rogers, Ltd. (Stand No. H.64).

BIFOCAL TUNING

(*Continued from page* 1070)

is determined by the way in which the station is coming over before you focus.

If the desired transmission is subject to interference from another station the focusing plungers should be pulled out. Do not be surprised if the action of pulling out the plungers reduces the strength of the station to which you want to listen. That is almost bound to happen, but the plungers should only be pulled out until the interference has disappeared. Then, leaving the focusing controls set in that position, the strength of the desired station can be restored by the use of reaction.

By the way, unlike the operation of the focusing controls, it is possible that readjustment of reaction will upset tuning to some extent. For this reason it may perhaps be found better, in the case of a station which is subject to interference, to increase the strength to something greater than is finally required *before* the focusing is attempted. Then, when the set has been focused and the strength of the station reduced in the process, it will probably be at the desired level.

Use a 'MICROLODE' with the BIFOCAL THREE

Extensive tests show that the great advantages in this new principle in set design become particularly apparent when a "Microlode" is used. Bifocal Tuning, with its effect of cleaning up reception is of the utmost importance to reproduction. The perfect balance obtainable by adjusting the "Microlode" switch places the set's performance still further above the average. In addition, the improved sensitivity and crisp attack due to the powerful Mansfield magnet bring vividness and clarity which are astounding.

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AN EFFICIENT INDOOR AERIAL

IT is generally conceded that the spectacle of wireless poles of various heights, diameters and degrees of verticality constitute a disfigurement to the otherwise orderly appearance of our suburban gardens. In the following description I propose to give details of a means of dispensing with the outside aerial system, substituting for this an efficient internal aerial.

In the attic of the house, as shown in the diagram, fix into the woodwork at the points A, four insulated screw hooks, as high up as possible, but keeping the hooks about 18 inches apart. Stretch between these hooks some No. 18 insulated bell wire, bringing the ends down to near the ceiling joists as shown at B.

Now procure from the ironmonger a $\frac{3}{8}$-in. gimlet or auger, about 18 inches long. This is to be used in making a hole through each floor for the aerial to pass from the attic to the set. Now bore with the gimlet a hole through the ceiling of the front room directly above the set and about 3 in. from the wall.

Drill Through Everything.

Let the gimlet pass right through to the first-floor room above; without lifting any floorboards, lino or carpet—bore right through. Before withdrawing the gimlet attach a length of linen thread to the screw end of it, so that on withdrawing it you will leave the thread in the hole, to be used later for drawing the aerial wire through.

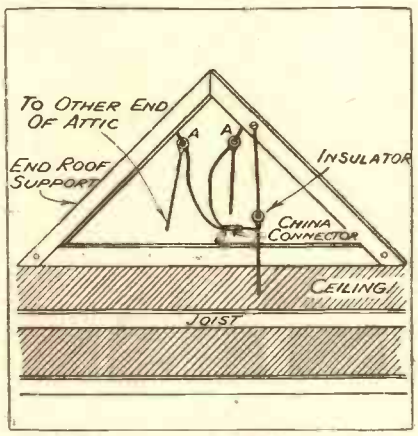
Repeat the same operation in the ceiling of the first-floor front room. Having prepared the way for the aerial to descend, it will now be necessary to thread a length of bell wire through the holes.

Pass one end of the wire through the first-floor ceiling into the attic, and attach it to an insulator which should hang directly over the hole from which the wire emerges. Connect the wire by means of a one-way china connector to the two ends of the horizontal aerial, as shown at B. This completes the work in the attic.

Next attach the other end of the wire to the linen thread which was left in the hole in the lower floor and pull it through.

The holes can now be filled in with a little plaster of paris around the wire. **J. A. C.**

SIMPLE TO ERECT



The author's suggested method of erecting an efficient aerial in the attic.

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Belling-Lee terminals are carefully designed and manufactured to get really good electrical contact. All the leading designers specify Belling-Lee for their constructor sets. Use these connections in your "Bifocal Three" and obtain the perfect results of which this ultra modern receiver is capable.

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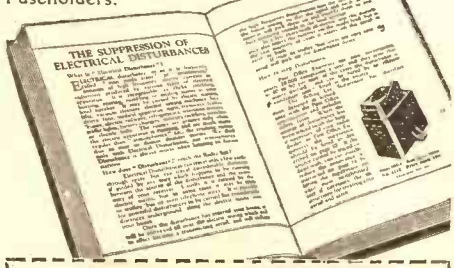
Describing the Mains Disturbance Suppressor (won't cure atmospherics), Pick-ups and relative diagrams; Radio connections including Terminals, Plugs and Sockets, Mains Connectors, etc. Fuse Data, Circuits and I.E.E. Regulations. Fuses and Fuseholders.



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P.W.3.

THE B.B.C. AND TECHNICAL DEVELOPMENT

(*Continued from page* 1079.)

well advised to avoid capital commitments on new stations beyond the present programme, which will be complete with the reconstruction of Daventry and with the new stations at Newcastle, Elgin and in Northern Ireland.

The Trade Aspect in the Future.

Looking to the future, there will be need of closer and more sympathetic co-operation between the B.B.C. and the wireless trade than there has been since 1926, when the Broadcasting Company became a public corporation. This will call for some change of attitude on both sides, but more particularly on that of the B.B.C. No important technical change or development should be undertaken by the B.B.C. without the fullest consultation with the trade. In this era of the mass production of wireless sets and components the B.B.C. cannot afford to leave out of account the trade angle on changes.

Likewise the wireless trade, in all its branches, should come to realise more definitely that the B.B.C. is an ally essential to its success.

One point in conclusion: On the technical side the B.B.C. should do much more than it does in explaining to listeners the difficulties encountered and the means of overcoming them.

LISTEN TO THESE NEXT WEEK!

Sunday — *March* 4

National: Orchestral Concert from the Grand Hotel at Eastbourne. Tom Jones' farewell concert as leader of this popular orchestra.

Monday — *March* 5

National: "The Egypt's Gold." A play founded on recent exciting events when attempts were made to salvage the £1,000,000 treasure from the liner "Egypt."

North Region: "Ten-twenty-thirty-forty Years Ago." A popular concert of reminiscences.

Tuesday — *March* 6

National: "Ladies and Gentlemen—A. J. Alan" (who will repeat his story on the Regional wave on Wednesday).

Regional: "This Radio Racket." Truthful (!) disclosures of what goes on behind the scenes in broadcasting. Cast includes Lawrence Baskcomb, Philip Wade and John Rorke.

Wednesday — *March* 7

National: A Variety Programme. Charlie Kunz, leader of the Casani Club Orchestra, will be heard in a new rôle when he plays syncopated piano solos.

Thursday — *March* 8

North Region: A relay by the Carl Rosa Opera Company from the Grand Theatre, Leeds.

Friday — *March* 9

Regional: "Julian Wylie Presents . . . ." The second in the series of light musical shows inaugurated by C. B. Cochran. Many pantomime stars will be heard in this programme.

Midland Region: Three Short Plays by the Birmingham Repertory Company relayed from the studio in the Theatre.

Saturday — *March* 10

National / Regional: "Tea Mixture." The second in the series of afternoon variety shows.

Midland: "The Charcoal-burner's Son." A welcome revival of the dramatic story by L. du Garde Peach, music by Victor Hely-Hutchinson.

THE MANUAL OF MODERN RADIO

More Appreciations from Readers.

"A MINE OF INFORMATION."

(*From H. Groves, 76, Ealing Road, Brentford, Middlesex.*)

I wish to thank you for "The Manual of Modern Radio." I am more than pleased with it. It is a veritable mine of information, and I am very grateful to Mr. Scott-Taggart for compiling such an interesting book. I am sure it is going to prove a wonderful boon to people like myself (radio fans). I also take this chance of thanking POPULAR WIRELESS for being the means of placing such a work before its readers.

"A COMPREHENSIVE AND CLEARLY-WRITTEN WORK."

(*From John McK. Slater, 19, Yeaman Place, Edinburgh.*)

POPULAR WIRELESS has again scored in offering such a presentation volume as John Scott-Taggart's "Manual of Modern Radio." It is a great pleasure to possess such a comprehensive and clearly-written work.

My hearty congratulations to "P.W." and Mr. Scott-Taggart.

"MAKES FINE READING."

(*From E. G. Clark, 21, Oliver Street, Luton, Chatham, Kent.*)

The contents of the volume have exceeded my expectation, and make such fine reading even for those who do not bother about set construction. My heartiest congratulations to "P.W." and also to Mr. Scott-Taggart, who by now is known nation-wide in the radio world.

"SHOULD BE IN EVERY HOME."

(*From T. Bevan, 5, School Lane, Hoylake, Wirral, Cheshire.*)

Many thanks for the wonderful volume of Mr. J. Scott-Taggart's "Manual of Modern Radio." I cannot express my appreciation enough; in fact, in my opinion, it should be in every home where there is a radio set. It is so up to date and yet so simple that a child could understand it.

"A WONDERFUL STORE OF INFORMATION."

(*From O. S. Kennaly, 113, Dalston Lane, Hackney, E.8.*)

I wish to thank you for the very excellent book by Mr. John Scott-Taggart, to whom I also wish to express my thanks for the wonderful store of information contained in his latest and without a doubt his best book.

If all books on Radio contained as many useful articles there would be fewer grey hairs.

"HIGHLY DELIGHTED."

(*From W. McCauley, 10, Dalgety Street, Edinburgh.*)

I received my "Manual of Modern Radio" yesterday, for which I wish to thank you.

To say that I am highly delighted with it would certainly be putting it pretty mildly. Whoever thought out your scheme sure had a brain-wave and a warm heart for radio fans.

"ANOTHER TRIUMPH."

(*From H. Ward, 16, Orelia Terrace, Queenstown, Co. Cork.*)

I have great pleasure in being one of the many readers of "P.W." to acknowledge the receipt of your splendid presentation copy, "The Manual of Modern Radio."

To praise the book will take some doing, so all that I can say is that it is another triumph for "P.W." and the author, Mr. J. Scott-Taggart.

"THE MOST VALUABLE BOOK ON RADIO YET PUBLISHED."

(*From R. Wood, 24a, Station Road, West Croydon.*)

Your lucid text and very clear illustrations and diagrams make "The Manual of Modern Radio" the most valuable book on radio yet published.

Also a word of praise for the "S.T.400." I have now had mine nearly a year, and would not exchange it for any other set in England. This is the only set I have had that has been in commission more than six months or so, but I can safely say I shall still have my "S.T.400" next year.

"ONE OF MY MOST PRIZED POSSESSIONS."

(*From P. L. Fielding, 75, Stockport Road, Lydgate, Oldham.*)

I wish to thank you sincerely for my copy of "The Manual of Modern Radio."

When I received it I was more than pleased with it—I was delighted. And now that I have had the opportunity of glancing through the contents—well, I don't know how you do it!

However, you've "done it again," and "The Manual of Modern Radio" now ranks as one of my most prized possessions.

I take off my hat to John Scott-Taggart and POPULAR WIRELESS.

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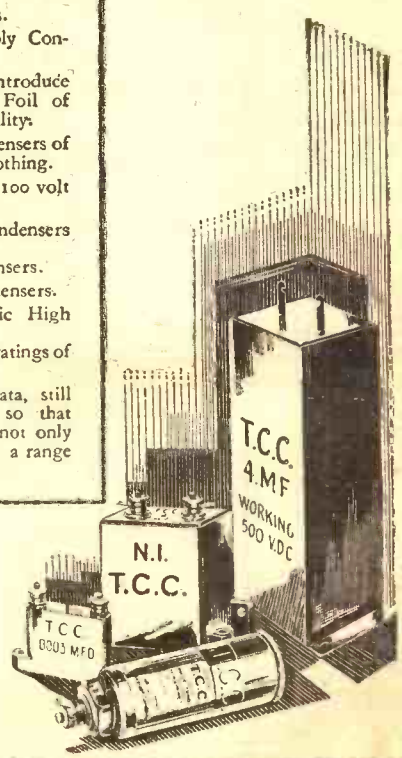
1929 T.C.C. introduce Dry Electrolytics for 100 volt working.

1930 T.C.C. introduce Moulded-in Mica Condensers—the now famous "M" Type.
T.C.C. introduce Non-inductive condensers.

1931 T.C.C. introduce Wet Electolytic Condensers.

1932 T.C.C. manufacture Dry Electrolytic High Voltage Condensers—(550v. peak).
T.C.C. first to publish Surge Voltage ratings of paper condensers.

1933 T.C.C. research still building up data, still adding to its specialised knowledge so that Radio Technicians may have available not only a "pedigree" range of condensers, but a range ahead of time.



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TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

Why Not a Separate "B" Unit?

READERS often ask whether it is possible to use Class B amplification with a small compact set such as a portable, and how the necessary components are to be got into the receiver, which is already as full as an egg.

If there is no more room in the cabinet, that supplies the answer itself so far as putting any extra components inside it is concerned; but there is another way out of the difficulty, and that is to use a separate unit outside the cabinet.

These units, known as Class B converter units, are now obtainable, and are very handy indeed for anybody wanting to make the change-over; in fact, their handiness is not confined only to cases where there is insufficient room in the cabinet, but they may be used in other circumstances as well for the saving of trouble.

No Alteration to Wiring is Necessary.

You can often find some suitable position, say at the back of the cabinet, where you can fit the converter, and then all you have to do is to take out the last valve of the set, put in the adaptor plug supplied with the unit, and then put back the valve in the socket which is available for it in this adaptor plug. This avoids any alteration in the wiring of the set, and the loud-speaker is operated from the Class B converter unit.

Some Points to be Watched.

There are, however, just one or two points which need attention, although the use of this converter unit is so simple. If you have a couple of stages of low-frequency amplification it may be better to plug the adaptor into the socket of the first L.F. stage rather than the second.

A wander-plug is provided for connection to the anode socket of the last valve, which, of course, is ruled out by this arrangement. The valve which you use in this first low-frequency stage may not be suitable as a driver valve for the converter unit, and it is worth while trying the interchange of the output valve for this one to see if it works better.

The Importance of Grid Bias.

I need hardly mention the importance of the grid bias of this valve, which, as you no doubt know, makes a great difference to the high-tension current consumption.

Many people use high-tension mains units for the operation of what would ordinarily be described as battery receivers; this is, of course, in order to do away with the need for replacing the high-tension battery. If you have electric mains available the logical thing seems to be to go right over to all-mains working.

But I will say something more about that presently. In the meantime, what I was going to say was about using a high-tension unit in connection with Class B amplification.

Economising Anode Current.

One of the objects of Class B is to economise current, and if you use a mains unit the economising of current is relatively unimportant, so that in these circumstances there would seem to be little point in going over to Class B from ordinary working.

Of course, if the unit is able to supply plenty of milliamps it may be all right; but in such a case why not stick to an ordinary straight L.F. amplifier with a good power valve in the output stage, or try the push-pull arrangement which I described in these columns quite recently?

Two-Electrode Detector Valves.

I have several times been told by readers of these Notes about the results they have got with two-electrode valves as detectors. Perhaps I should say not strictly two-electrode valves, because in all cases they use ordinary three-electrode valves with some special arrangement for employing only the filament and another electrode.

Many interesting circuit arrangements can be used with a two-electrode detector, and it has the advantage of giving a better characteristic curve than the three-electrode valve, although, on the other hand, it does not amplify. Incidentally, quite a lot of people do not seem to realise that the ordinary three-electrode valve used as a detector in the conventional way amplifies to an important extent.

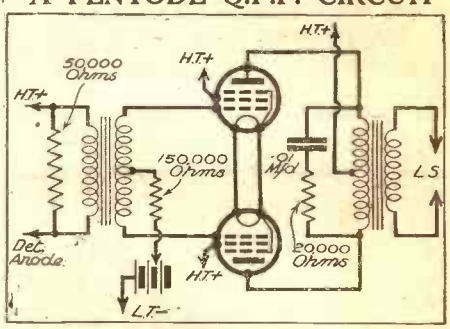
Many people regard the detector as merely a rectifier, but in the conditions in which three-electrode valves are generally used in conventional circuits as detectors they amplify quite a bit.

Connect the Grid and Anode Together.

If you want to make any tests with a three-electrode valve for the purposes of a

(Continued on next page.)

A PENTODE Q.P.P. CIRCUIT



In the accompanying diagram is shown a Q.P.P. circuit for pentode valves, indicating the arrangement of input and output transformer and also how the screen grids of the valves are separately connected to H.T. positive.

The fixed resistance across the primary of the input transformer should have a value of about 50,000 ohms, and it acts to protect the valves when there is an interruption in the anode circuit of the preceding valve.

You will also note the condenser and resistance which are connected in series and across the primary of the output transformer. This is really an ordinary tone corrector arrangement in one sense, and it also acts to protect the transformer primary.

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TECHNICAL NOTES

(Continued from previous page.)

two-electrode detector you can use either the anode or the grid as anode; but if you are going to use only one it is better to use the grid, leaving the anode "up in the air." The ordinary anode of the valve is thus not used at all, whilst the grid serves the purpose of the anode.

This arrangement has the drawback that some of the electron stream from the filament will pass through the grid and will give a static charge to the original anode, which charge will gradually increase and may upset things.

Personally, when I have used valves in this way I have always made a practice of connecting the anode and grid together and using them as one electrode. This does away entirely with any stray electrification, and I think you will find it more satisfactory.

Moving-Coil Interference.

A reader wants to know whether there is any danger of interaction between the field of a moving-coil loudspeaker, incorporated in a set, and the neighbouring components.

HAVE YOU HAD YOUR S.-T. MANUAL?

Gift token No. 7 appears on page 1100 of this week's issue. If you have now collected six of these tokens, you should complete your Gift Voucher at once and post it, with the necessary remittance, without delay.

IF YOU WANT YOUR MANUAL QUICKLY

you should send in your voucher quickly. Applications will be dealt with in strict rotation.

Please note that *two* tokens appear on the last page of this issue—one for "The Manual of Modern Radio" and one for "Practical Knowledge for All."

The Manual token is clearly marked and is numbered 7. Do not confuse them.

TURN TO PAGE 1093.

About the only electrical disturbance which can be caused by the loudspeaker is due to the D.C. current which is supplied to the field or "pot" of the speaker. This will probably be supplied from A.C., rectified and smoothed (although often enough a good deal of the smoothing is left to the impedance of the pot winding itself), and if the smoothing is insufficient you may get some sort of an A.C. hum picked up by neighbouring components if they are too near to the speaker. It goes without saying, also, that the speaker should not be too near the H.F. end of the set.

Acoustic "Reaction" Effects.

What is more likely to happen with a powerful speaker in close proximity to the other components, particularly the valves, is acoustic reaction, or a sort of microphonic effect, owing to the direct impact of the powerful sound waves from the speaker on these components setting up mechanical vibrations which are translated by the valves into electrical low-frequency oscillations.

(Continued on next page.)

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P.W., 3/3/34.

TECHNICAL NOTES

(Continued from previous page.)

All-Mains and Battery Sets.

It is curious how people who use all-mains receivers often adopt an air of superiority to owners of battery receivers, notwithstanding the fact that battery receivers must be enormously in the majority. I do not think the exact figures have ever been ascertained, but I have seen the figures put semi-officially at something like 60 to 70 per cent of battery receivers as against 30 per cent of other kinds.

It is true that when mains receivers first came along they generally gave a good deal more power and punch than battery receivers, and also in some ways the improvements in A.C. valves have led to great improvements in the *quality* from mains sets. For a time the battery receiver was perhaps at a disadvantage, particularly as attention was concentrated on improvements in A.C. valves and all-mains working generally.

Quiescent Push-Pull Output.

But with the advent of Class B amplification and quiescent push-pull it seems that the battery set has come back into its own again, and there is really no reason now why battery receivers should not give every bit as good quality as most mains sets. This is an important matter, because, as I mentioned above, the battery public is so much larger—at present, at any rate—than what we might call the mains public.

"Regulation" With Mains Units.

I have said something about people who have battery sets running them with batteries for the L.T. and mains units for the H.T., or perhaps with a mains unit for H.T., L.T. and grid bias. This is quite all right in its way, and there is no doubt that there are now some very excellent mains units on the market which will supply ample current for H.T., with intermediate voltages for screened-grid and pentode valves, as well as grid bias and L.T., and with very good "regulation."

A Transitional Benefit.

But, personally, I always regarded the mains unit or eliminator as what you might call a "transitional benefit," which would tide over from the time that the electric light was installed to the time when a new set was called for. Some people, however, although the electric light has come along since they bought their last battery receiver, actually go in for another *battery* receiver, with mains unit, or perhaps they have already got a mains unit and think that they will economise by keeping the unit and getting another battery set to work with it.

But surely the logical thing to do when the electric supply has become available is to go in for a full-blooded all-mains set complete and to leave the mains units and eliminators to those who, as I say, are in the transitionary stage.

Screen-Grid Rectifiers.

Reverting to the use of two-electrode valves as detectors, by the way, which I mentioned before, I dare say you know that a screened-grid valve can also be used as a detector, with the ordinary values of grid leak and condenser, provided you take certain precautions with the anode circuit.

It is generally advisable not to use a transformer, because you are apt to get the high notes brought out more strongly, which makes the bass seem deficient. It is true you can cure this to some extent by connecting a suitable resistance across the primary of the transformer, but this does not really make matters a lot better.

Resistance or Choke Coupling?

Resistance coupling is more generally used with this arrangement, but here again you must take care that sufficient H.T. voltage is used. It is best to use all the available voltage for the H.T., adjusting the voltage on the screen, of course, so as to get sensitivity and good quality at the same time.

If you wish you can use choke coupling instead of resistance coupling, and this has the advantage that the voltage lost in the choke is generally a good deal less than that lost in the resistance. If you use choke coupling, by the way, it is important to choose a choke with a pretty high inductance.

EUROPE IN FOCUS

WITH THE

"BIFOCAL THREE"

This unique receiver, designed and presented by the Radio Industry, was recently handed over to the "P.W." laboratories to undergo the most stringent practical tests.

Next week we publish the results of these tests, which will prove conclusively that the "Bifocal Three" is, in practice as well as in theory, the one home-constructor design which overcomes — almost automatically — the chaotic conditions of modern reception.

READ

POPULAR WIRELESS

NEXT WEEK

Using Screened Coils.

When using screened coils you want to bear in mind that the screen affects the characteristics of the coil and also its efficiency. I have mentioned this point before, but I know it is often overlooked.

The presence of the screen has the result of reducing the inductance of the coil, and this means that extra capacity has to be used in order to tune to a given wavelength.

The screen also affects the high-frequency resistance of the coil. The position of the screen in relation to the coil is another important matter, and great care should be taken to use a screen which is not too small, that is, which goes into too close proximity with the coil.

A general rule is to make the screen diameter about twice the diameter of the coil.

DO YOU GET GOOD QUALITY?

Showing how the characteristic tones of four individual instruments in the orchestra will help you to judge the quality of your receiver.

IT is a commonplace to state that the quality of a wireless receiver is revealed by its ability to make the individual tones of the various instruments of the orchestra clearly distinguishable. This is true enough.

But I think it would be useful to consider, in turn, a few instruments which will enable us to come to some conclusion regarding the general quality of our receivers. For this purpose I will take four instruments only: the 'cello, the viola, the horn and the trumpet.

"The Viola is a Shy Bird."

The 'cello demands really good low-note reproduction in the speaker to give of its best. Its special quality should be examined in a solo performance rather than in the orchestra.

On its lowest notes you should hear a deep, brump-ph, field-marshalish quality from its broad corporation.

The viola is a very shy bird, but can be found modestly disporting in a chamber-music programme. There are, of course, clusters of violas in the orchestra, but I advise you to search for one within a string quartet.

If you cannot, within a few moments, distinguish its soft, round, burr-like note flitting about between the violins and the 'cello, you must, in the classic phrase of the B.B.C., "look to your set."

In the brass section of the orchestra the horn and trumpet have, in my opinion, the necessary outstanding character that is required for their prompt recognition by the wireless amateur.

A Sharper, More Vivid Note.

The horn has a softer, rounder tone than the trumpet and is capable of the most beautiful expressive sound. Opportunities to listen to the horn as a solo instrument are rare, though there are, I believe, one or two horn concertos and other compositions in which it plays a considerable part.

The trumpet has a sharper, more vivid and piercing note than the horn, and here again the orchestra must be your hunting ground.

I wish the B.B.C. could be persuaded to broadcast for this purpose that splendid scene in "Aida," with its blaze of trumpet sound. When you have experienced this thrill the trumpet will take its place for ever as a real voice in the orchestra.

Finally, these four instruments have not been chosen at random, but have been mentioned because they make some special demand upon the receiving apparatus, or because they possess an outstanding character which entitles them to a position as "key" instruments in a simple outline of this kind. **C.J.D.**

"PRACTICAL KNOWLEDGE FOR ALL" TOKEN 1 | "S.T." MANUAL TOKEN 7

Printed and published every Wednesday by the Proprietors, THE AMALGAMATED PRESS, LTD., The Fleetway House, Farringdon Street, London, E.C.4. Advertisement Offices: John Carpenter House, John Carpenter Street, London, E.C.4. Registered for transmission by Canadian Magazine Post. Subscription rates: Inland and Canada, 17/4 per annum. Abroad (except Canada), 19/6 per annum. Sole Agents for Australia and New Zealand: Messrs. Gordon & Gotch, Ltd.; and for South Africa: Central News Agency, Ltd. Saturday, March 3rd, 1934. S.S.

POPULAR WIRELESS
THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

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COMPLIMENT FROM U.S. TELEVISION CROWDS EMPIRE MARKETS RUINING "ROOTERS"

RADIO NOTES & NEWS

A CONVENT STATION SANG FOR SUPPER HUMAN AERIALS 'PHONES AND CORNS

A Generous Tribute to "P.W."

IT is with great pleasure that I see in "Radio-Craft," that first-rate American magazine (edited, I believe, by Hugo Gernsback, the real old-timer of radio journalism over there), a reproduction of one of our circuits and the comment that it is one of the first circuits that they have seen published using delayed automatic gain control.

That will show you where "P.W." stands internationally! Returning the compliment, I give "Radio-Craft" priority for that electro-trombone thing. I have not seen it before or since.

Radio Plumb for Volcano.

A PLUCKY group of scientists, one of whom is a monk, is to descend into the crater of a Chilean volcano called Quizapu. Don Q. is active, by the way, and is the fellow who sported volcanic ash all over the southern part of South America in 1932.

These human salamanders are to take with them, amongst other things, a radio apparatus, presumably akin to Marconi's Echometer, for measuring the depth of the hole.

The monk, Father Domingo Conde, is head of the Geophysical station at Talca. Knowing a good deal about South America, I have been struck by the way in which the monks predominate in scientific work, especially radio.

In Spite of Himself.

MOLIERE'S "Le Médecin Malgré Lui"—"A doctor in spite of himself"—seems to have had a counterpart in the late Dr. Ferranti. The story goes that Dr. Ferranti, although he was not interested in broadcasting when it began here, nevertheless had to listen to his family's set.

And that set annoyed him because its reproduction hurt his ear. So he dissected it, and, finding that the L.F. transformer was the cause of his pain, promptly designed a much better article—with which most of us are now familiar.

A Huge Success.

LESLIE ORTON, of the Anglo-American Radio and Television Society, tells me that their television demonstration on February 7th was a huge success—at any rate, in so far as attendance and excitement count. People came from miles around Uxbridge, and the society's officials had to make traffic rules on the spot to cope with the crowds which tried to see the pictures.

By the way, Mr. Orton's latest catch is C F Q C (500 watts), Saskatoon, Canada, on broadcasting. Finally, if anyone heard V E - 10 B P (Wingham, Ontario) on February 8th, between 6 and 7.30 a.m., on 249·9 metres, will they kindly report to Mr. W. T. Cruickshank, 10 B P, Wingham, Ontario?

Obituary Note.

ALL serious students of wireless know and value their "Morecroft" and will be sorry to learn that the author of "Principles of Radio Communication," Dr. J. H. Morecroft, died in January from pneumonia contracted while he was watching Columbia University—where he taught electrical engineering—play football.

Dr. Morecroft was English, but was taken to America as a child. His career with the U.S.A. Navy Department during the war and as professor and writer has been both distinguished and useful.

Is "Saturation" Possible?

IN a report issued by the Department of Overseas Trade—one of the few Civil Service departments with which it is a pleasure to deal—it is stated that it seems as though saturation point is being reached in Denmark as regards licensed listeners.

There are 500,000 (approx.) Danish licences in force, or one per seven heads. Awfully sorry, sir, and all that, but I do not believe in the saturation theory except in respect of countries where the population is either stationary or decreasing. Think it out.

Our New Zealand Trade.

IN response to my sobs over the capture of the N.Z. radio market by America, J. W. S. (Auckland) sends me facts and figures to explain the catastrophe. English prices are too high—especially as American prices have been reduced, in some instances to nearly cost level—and English firms appear to be indifferent to the export trade.

He says that *Japanese* components are coming into the market there, made, he believes, under the direction of the R.C.A.—which I can hardly credit, as the R.C.A. itself sells American components. However, I am afraid that we are not forceful enough in export business. Write again, J. W. S.

Ariel Almost Ruins "Rooters."

IN passing, I must confess that, with the best of good intentions, I nearly brought financial ruin to the Old Original Rooters' Club, Star Hotel, Hyde, Cheshire, when I asked 10,000 of you to send a penny stamp for their card.

With a grasp of financial detail worthy of a mere banker, our fellow "P.W.-ist," D. L. L., explains to me, in a letter about the "National Eckersley Three," exactly how much his club would lose had you regarded my desire.

One penny for a penny card, a halfpenny stamp and an envelope! Well, thank goodness that you procrastinated! Send

(*Continued on next page.*)

NEARER—AND CLEARER . . . !

¶ That is the effect of focusing a foreign programme—it seems to come nearer and to grow clearer.

* * *

¶ Focused radio was introduced to the public only a week ago, but already it has won immense popularity and the new Bifocal coils are proving a simple method of station-separation.

¶ The first receiver expressly designed for focused radio was the "Bifocal Three," which was described in detail in last week's "P.W."

* * *

¶ You can escape your local with the Bifocal, for its adjustable iron-core coupling goes right to the core of the selectivity problem.

(See page 1103.)

FOCUSED RADIO!

OUR DAUNTLESS RADIO PIONEERS ABROAD!

'em threepence and lay up treasure in heaven.

Transmissions from a Convent.

SURELY Sister Mary Emiliana, of Providence, Rhode Island, U.S.A., is unique in that she has secured a licence to operate a radio station. Her station is situated in St. Xavier's Convent, her call-letters are W I H U H and she is permitted to use wavelengths of 5, 10 and 160 metres.

Unfortunately, the report in the "Universe" does not give the power of the set or state whether the lady will transmit telephonically or by Morse code.

However, you may run up against her signals one fine day, and if you do I hope you will give this progressive lady a "shout" of congratulation.

More Byrd News.

IT is claimed that station W A B C set up a new low-power long-distance record for short-wave telephony when it received messages from Byrd's ship, Jacob Ruppert, when that station transmitted on only 120 watts at a distance of about 8,500 miles.

It appears that the ship station, K J T Y, nominally of 1,000 watts, had a transformer burn-out, and when the hasty repairs were done only 120 watts could be used. The signals, as received in New York, seemed almost as strong as the 1,000-watts variety.

Radio Scientist Honoured.

DR. ARTHUR E. KENNELLY, an American of British origin, has been awarded the Edison medal, which is the highest award of the American Institute of Electrical Engineers. Dr. Kennelly has given his name to the ionosphere, the Kennelly-Heaviside Layer, that layer of the upper atmosphere which is believed to be responsible for the reflection of waves back to earth.

Advice to an Inventor.

TO the Scottish science student who tells us that he has invented an entirely new form of television, and who kindly leaves it to us to "inform those associated with the problem of television," I tender my congratulations and beg him to go ahead with patenting his invention if he can. He can then tell the world about it in comparative safety.

Singing for their Supper.

THE famous Huddersfield Choral Society, which up to last year had been conducted for over thirty years by Sir Henry Coward, evidently consisted originally of Little Tommy Tuckers, for in its early records—it was founded about 1836—I find it laid down that "Each member shall have allowed him three gills of ale and bread and cheese."

Perhaps some local historian can tell us how much bread and cheese was considered to be necessary to offset three-quarters of a pint of ale.

A Matter of Reciprocity.

I OBSERVE that, at the first annual dinner of the Nottingham Radio Luncheon Club, one speaker, in referring to the absence of B.B.C. representatives, naively remarked that, after all, it was the radio industry which procured the 10s. for the B.B.C.

One may respectfully ask how large that industry would be without the B.B.C. How would the theatre-ticket agencies prosper but for the theatre proprietors and/or lessees? Come, come! This is but to chase one's own tail. The B.B.C. and the industry are mutually interested in the licence-fee payers—but the latter has more to lose than the B.B.C., let it not be forgotten.

Radio in West Australia.

EVEN from far-off Perth the B.B.C. could take lessons. The Lancashire lad who sent us an Australian wireless magazine follows it up with a cheery letter all about the radio scene there, "P.W." sets and his experiences with them, and a eulogy of Sunday programmes as produced there. "I am strongly against dreary Sunday broadcasts," he says, and his words fit our case exactly!

He is surrounded by electric supply and telephone wires, his house has an iron roof, and a hundred yards away there are electric trams and a power station. Nothing can daunt the will of our pioneers overseas!

Yet Another Human Receiver.

PARANA, Brazil, provides the latest instance of a person who states that he acts as an aerial and hears broadcast without the usual apparatus. This celebrity, a Ukranian, is not at all elated with his good fortune, but complains that his reception keeps him awake, and he is asking the doctors to do something about it. Perhaps he could be cured by asking him to pay a licence fee for operating a portable receiver!

Exit Tom Jones (pro tem.).

TOM JONES was always a Sunday evening winner, and his departure from the Grand Hotel, Eastbourne, is bound to cause sorrow to thousands of us. Yes, thousands—and in many parts of the world. He once asked the B.B.C. to provide him with a secretary to deal with his enormous "fan mail," the saucy lad!

Well, may he have good luck and bob up again soon in some place where he will be broadcastable (a new word—*mine!*).

Tom's grandpa had such a large family that they were able to form an orchestra among themselves, and Tom led the first orchestra ever broadcast here. These are distinctions!

A Song with Action.

A GOOD story is told of Vladimir Rosing, the singer and classic interpreter of the "Song of the Flea." He was singing this song in Chicago, and upon reaching the words "a flea" he was disconcerted to hear a burst of laughter from his audience.

Observing that everyone's attention was fixed on the back of the platform, he turned and saw the cause of all the merriment. A pussy cat had taken up a position on the platform and was busily scratching itself!

Shun the Phones.

A CONTEMPORARY publishes a report on the danger of headphones to the elderly, whose circulation, it states, is liable to be retarded by those ear-blinkers.

I doubt the circulation danger, because the earpiece rests mainly on cartilage, but I can affirm that much use of headphones is liable to produce "corns" on the outer ear.

The only virtue ascribable to telephone reception is that the listener is rendered immune from the talk and paper rustling in which his ladyfolk will, in all probability, engage as soon as he switches on.

Oh, Sir Henry!

I CONFESS that I read with surprise, not unmingled with pain, that Sir Henry Wood admires the American radio scene. He likes competition, he is reported to have explained, and thinks that the battle of American broadcasting companies fighting for public favour is a good thing. Well, *I* think that I would rather not be battled over.

Sir Henry suggests that, without competition, the "ginger too often goes out of one's work." True and trite—but who asks for ginger? What we want is sanely balanced recreation in the fullest sense of the word "recreation." The Americans can have all my ginger, and welcome!

What They Like Best.

THE "Morning Post" squeezed or coaxed out of the B.B.C. some very interesting details of the Empire service. Judging, one presumes, from listeners' letters, the B.B.C. says that Australia prefers book reviews; Canada likes plays, sports talks and military bands; and the tropics, generally, prefer light entertainment, eschewing talks unless they are given by outstanding people.

As a result of its experience the B.B.C. is going to give up the 80-feet "Beam" towers now used and radiate from 350-feet masts.

ARIEL.

EUROPE in FOCUS

"P.W." Tests the "BIFOCAL THREE"

THE aim of all radio receivers is to pick out individual broadcast transmissions from the etheric conglomeration all over the world. The particular transmissions must be in accordance with the choice of the operator of the set, who must be able at will to say to himself, "I'll get such and such a programme," and forthwith turn his set's dials and *get it*. And, incidentally, with good quality.

That is the ideal for which all set designers strive. And it is an ideal that is by no means easy of attainment, especially with the present congested state of the broadcast wavebands.

The Essential Features.

The degree of difficulty in obtaining the combination of selectivity, sensitivity and quality of reproduction necessary can only be realised by set designers themselves and by those whose lot it falls to put the designs through their paces.

We have stated that it is essential for a receiver to be selective, to be sensitive and to give good quality if it is to provide real entertainment for the listener. True; but it must also be *easy of operation*, or its properties will be largely wasted.

What an ideal! And we who have the testing of hundreds of receivers—some home-constructor and some commercial designs—in the course of a year realise to the full how far short many sets fall and to what extent others approach the goal.

Set testing forms a large portion of our daily routine—sometimes monotonous, at others almost thrilling. But so used have we become to the task after many years in the laboratory that we inevitably view each arrival on the bench as "just another set to be tested." Mild interest may be aroused if startling claims have been made for it; but so often have we heard the cry of "wolf" that rarely do such claims evoke more than a slightly incredulous smile. We reserve all comments until the end of the tests.

A Band of Enthusiasts.

By all of which you will be gathering that the "P.W." Research Department holds a collection of tired, disinterested sceptics who are bored with the whole procedure of practical radio. That is not so. Sceptics, perhaps, in a controlled sense, but always ready to be convinced by meter or other tests of a receiver's claims to superiority. Tired and disinterested, certainly not.

Actually Room 5, Tallis House, contains a band of incurable enthusiasts, but it never does to allow enthusiasm to run away with common sense, and we have painted this picture of the "R.D." to give you an idea of the atmosphere of practical solidity into which the "Bifocal Three" was deposited by the British Radio Industry.

"We have produced the answer to the chaos of the Lucerne Plan," said the designers. "What do you think of it?" And they handed it over to the not-too-tender mercies of K. D. Rogers and his band of set dissectors.

Every listener to foreign programmes will be interested in this description of focused radio on test in the "P.W." Research Department. It tells how the new type of Bifocal receiver—introduced to the public last week—proved to have an extraordinary power of station discrimination, and enabled interfering programmes to be thrown right out of focus with the utmost ease.

By a "P.W." TECHNICIAN.

They also handed over a copy of the brochure which you will have seen in last week's POPULAR WIRELESS, and with a few final affectionate glances at the set, looking ridiculously small and impotent on the vast test bench, they bade it a reluctant farewell.

Whatever one is inclined to think of a set from first appearances or from a brief study of its circuit, one has to banish all such impressions till the test is over. Fair play must be given to each receiver, and the only way to ensure that is to make certain *before* the tests are begun that the operation of the receiver is fully understood, that perfectly rigid meter tests are applied—not merely an aerial check to see how many stations it will receive—and that every feature of the receiver is analysed separately before the final aspect, as it affects the ordinary listener, is considered.

This latter aspect is, of course, the ultimate key to the success or failure of the receiver; but whether a set fails or succeeds as an instrument in the hands of the listener, one should know why. It is as important to know what is right with the set that is being tested as it is to find out what is wrong, and we always try to analyse the sets that come to us for test in that way.

Finding the H.T. Consumption.

So the "Bifocal Three" was met with the same polite incredulity as that of many other sets that have claimed to solve either this or that problem. But this scepticism was, we must admit, tinged with a certain hope, for the claims of the new Varley coils did ring true. The idea was new. It was sane, and so it was with unusual curiosity that we set the receiver up for test.

We said earlier that the "Bifocal Three" looked ridiculously small and impotent as it lay on the test bench among the meters and oscillators of the radio inquisition. It did; but, small though it certainly is in physical dimensions, it is by no means impotent.

The first test did not take into account the radio section of the receiver other than as a means of receiving a fixed modulated carrier. It was H.T. consumption we were after. With 13·5 volts bias, 120 volts H.T. on H.T.+2 and 75 volts on H.T.+1 we registered an H.T. current of only 5·2 milliamps when no "signals" were being received.

AN UNUSUALLY WIDE WAVELENGTH RANGE

One virtue of the iron-core coil employed in the "Bifocal" design is that it enables the ·0005-mfd. tuning condenser to tune over a much wider waveband than usual. Mr. K. D. Rogers found that on medium waves the set went down to 195 metres and up to 590 metres, and its long-wave range was equally comprehensive.

Excellent Response.

This rose to some 19 milliamps at full peak load, giving an average of 10–11 milliamps for ordinary reception. Very good indeed, for the output power of the set is round about 640 milliwatts. The "Autocontrola" was evidently doing its job.

The audio-frequency response of the set was then checked, and this was found to be exceptionally good. Bass and top notes were nicely balanced, giving a realism in reproduction that was very satisfying.

Next came the usual tests of the high-frequency end: sensitivity, selectivity (maximum and minimum) and wavelength range. For these we use a miniature broadcasting station with a modulation of

(*Continued on next page.*)

EUROPE IN FOCUS

(Continued from previous page.)

some 60 per cent and a field strength that can be varied from practically nothing to that approaching a local station a mile or so away.

Without going into figures we can say that the "Bifocal Three" possesses a sensitivity that is far above the average, with a selectivity that is amazing for a two tuned-stage receiver. In this latter property the designers' claims are certainly justified.

It means (as was shown later in abundance) that the set is capable of bringing in foreign stations with a certainty that is most gratifying and at a strength and with a freedom of interference that is most unusual. The aerial tests that followed amply proved the practical worth of the receiver.

An Exceptional Design.

The wavelength range, too, was astounding, being some 195 to 590 metres on the medium band and 980 to over 2,200 on the long waves. Obviously the coil designers did not mean to miss much!

So far our tests had shown us that the "Bifocal Three" is economical, sensitive, very selective, gave good quality and covered a vast waveband. It does not need any great power of deduction to realise that it is an exceptional receiver of the highest capabilities.

With so much determined—though it took much longer in practice than it does to tell you—we were now really eager to hear the set on the air, and a very long time was spent with it during an evening test on the aerial at Tallis House.

Here we are near enough to the two London stations to check thoroughly the selectivity, and in a bad enough position from a foreign reception point of view to give the receiver a severe test for sensitivity.

Stations by the Score.

It laughed at the task we imposed, and it was not long before critical intent gave place to real practical enjoyment. We started logging stations by the score, and, assisted by the uncannily accurate and absurdly simple focusing controls, got those stations remarkably free from interference.

If a station was interfered with, movement of the focusing controls soon put matters right. Often it was necessary to move only the left-hand control, regulating the aerial-coil coupling, but in cases of bad interference both had to be adjusted.

Amazing Selectivity.

The ease with which stations were cleared of their interference surprised even the hardest boiled in the department, and it was not long before criticism gave way to enthusiasm. Station after station rolled in, each time with the focus controls "out," to be cleaned up at will by the simple expedient of pushing them in and very slightly readjusting the tuning. The extremely small effect that focusing has on the tuning is astonishing, and makes the handling of the set simplicity itself.

Here are some of the dial readings we obtained, and though they may not be dead accurate for every "Bifocal Three" built, they will be near enough to act as a valuable guide to tuning:

London National, 30; North National, 41; London Regional, 50; Midland Regional, 60; North Regional, 72; Prague, 79; Budapest, 90. In between these such stations as Bari, Scottish National, Hilversum, Poste Parisien, Hamburg, Berlin, Scottish Regional, Leipzig, Munich, Rome, Brussels I and Vienna stood out like landmarks among a host of smaller fry that came in all over the dial.

The long waves were also there for the asking, the "pirate" station of Luxembourg making a great song and dance on 1,304, while 5 X X, Radio Paris, Moscow I, Huizen (Kootwijk) were all received at good strength.

A Set to be Built by All.

We did not try for any American stations—12 midnight is rather late—but, given reasonably good conditions, we see no reason why the "Bifocal Three" should not be able to focus quite a nice bag of U.S. broadcasters as well as the most gratifying selection of Europeans.

Our test took many hours. It has had to be condensed in story form to two pages, so we have been able to give but a slight idea of what happened and how the set behaved. We must conclude, however, with the definite assurance that, in our considered opinion, the "Bifocal Three," the first set to be designed and presented to the home constructor by the Radio Industry, is a set to be built by all.

It does the job for which it was designed. And that is saying a great deal, for the sorting out of Europe's ether is no small matter. But the "Bifocal Three" does it. It gets the stations, and then it sifts the wheat from the chaff. Like a pair of binoculars, it magnifies and differentiates. As through the glasses you see just the object you are looking at, and that more clearly, so in radio the "Bifocal Three" picks and focuses the required station from the rest and magnifies it to the exclusion of the rest.

Easy to Construct and Operate.

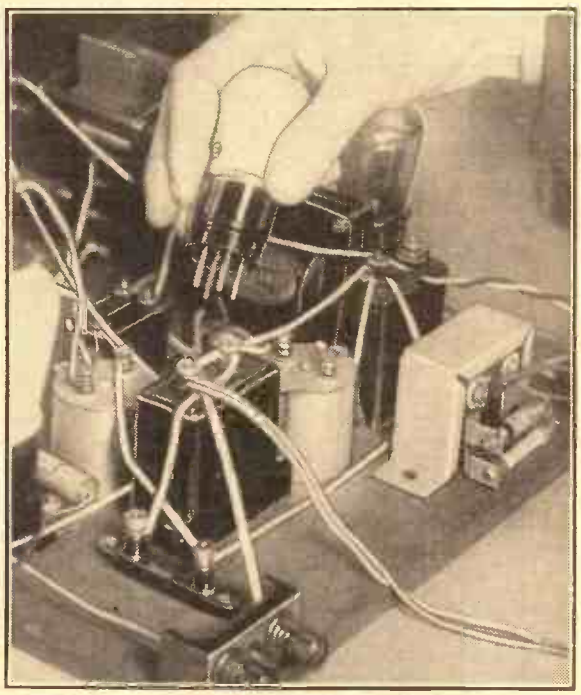
A simple receiver—easy to construct, easy to operate—that will accomplish this is worthy of the highest commendation.

Europe is still trying to sort out the chaos on the long waves; the medium band has been cleared *as far as possible*, but pandemonium still exists for owners of ordinary receiving sets.

It takes something of the order of the "Bifocal Three" to provide simple but effective selection of the required programmes that are jumbled up in a hard-worked ether.

It is a superb set, well designed, and we congratulate the Radio Industry on it.

LOW ANODE-CURRENT CONSUMPTION



Embodying a special economiser unit for prolonging H.T. battery life, the "Bifocal Three" is unusually low in running costs considering the power it develops. The valve which is shown being withdrawn in this illustration is the detector (V_2), the pentode being to the right of it and the S.G. to the left.

Components

2 Varley "Bifocal" coils.
2 J.B. ·0005-mfd. Popular Log slow-motion tuning condensers.
1 J.B. ·0003-mfd. differential reaction condenser.
1 Ferranti A.F.4 L.F. transformer.
1 Ferranti 50,000-ohm resistance (new type).
1 Ferranti 5,000-ohm resistance (new type).
2 Bulgin type S.105 switches.
2 Bulgin standard H.F.9 chokes.
1 Benjamin "Autocontrola."
2 Benjamin 4-pin valve holders, "Vibrolder" type
1 Benjamin 5-pin valve holder.
1 Benjamin push-pull on-off switch (type with terminals).
1 Dubilier 2-mfd. fixed condenser, type BB.
2 Dubilier ·0002-mfd. fixed condensers, type 620.

FOR THE "BIFOCAL THREE"

1 Dubilier 2-meg. grid leak, 1-watt type.
1 Dubilier 100,000-ohm resistance, 1-watt type.
1 Westinghouse "Westector," type W.6.
1 T.C.C. 2-mfd. fixed condenser, type 50.
1 T.C.C. ·1-mfd. tubular fixed condenser, type 250.
1 T.C.C. ·0001-mfd. fixed condenser, type 34.
4 Belling-Lee type R terminals, engraved "A," "E," "L.S.+" and "L.S.—"
2 Belling-Lee terminal mounts, catalogue number 1039.

Sundries

1 Ebonite panel, 12 in. × 7 in.
1 Plywood baseboard, 12 in. × 10 in. × ¾ in.
1 S.G. anode connector.
4 Wander-plugs, engraved "H.T.+1," "H.T.+2," "G.B.+" and "G.B.—"
2 Accumulator spades.
1 Fuse-type wander-plug (black for H.T.—).
2 10-ft. coils of insulated connecting wire.
Flex, screws, etc.

Valves

S.G. Valve (V1).—Cossor 220 S.G.
Detector Valve (V2).—Cossor 210 H.F.
Output Valve (V3).—Cossor 220 P.T.

Batteries

H.T. 120 volts.—Exide Type H.1074.
G.B. 16½ volts.—Exide Type H.1002.
L.T. 2 volts.—Exide Type DMG.

You Can't Go Wrong with the "BIFOCAL THREE"

Focused radio has scored a triumphant success in the "Bifocal Three," recently introduced to our readers, and below we give some further details, together with a summary of opinions extracted from the letters of leaders of the radio industry.

The fact that such an entirely novel departure from ordinary practice as the "Bifocal" should immediately find such wholehearted support all over the country is a remarkable tribute to the great new principle it embodies.

THE average Englishman is a very placid sort of individual. His inborn characteristic of adherence to the old principles tends to make him very tardy when it comes to a radical change; indeed, in general it is only when that change is forced upon him by circumstances outside his control that he is persuaded to take the plunge.

But this conservatism never dominates his common sense.

Only a matter of a week ago "P.W." gave to its readers the first and exclusive details of an entirely new principle of radio reception, a principle destined to have very far-reaching effects in the world of home-constructor radio.

Everybody "Focusing" Crazy.

Ordinarily we, too, are inclined to be cautious, and we jib at lending our support to anything which might tend to put our readers to expense unnecessarily. It is only by rigid adherence to such a policy that we have been enabled for eleven—nearly twelve—years to maintain our premier position in the realm of technical journalism.

The first presentation by "P.W." of the great new principle of "focused" radio, and our enthusiastic support of the scheme generally, represents no departure from that policy. The seriousness of the wavelength situation in Europe at the present time, and the failure of the Lucerne Plan completely to overcome the difficulty, made it abundantly clear that the next move was in receiver design. That is why, when the opportunity came our way, we were quick to realise the vast possibilities of such a momentous development and, in the interests of our readers and of broadcasting generally, were quick to act upon it.

To-day, as a direct result of the details given in the last issue of "P.W.," the country is "focusing" crazy! No scheme for the attainment of better radio has ever caught on so universally and so fervently as this one. No matter where you go—in trains, in restaurants, in clubs and (s-sh!) in offices—the one topic of conversation among home constructors, and, in fact, among everybody interested in radio, is *focused radio* and the already famous "Bifocal Three." Our various correspondents throughout the country can vouch for that.

Making Radio History.

But what does it all mean? It means that for once that inherent British characteristic of conservatism has very definitely given way to common sense. It means that the public is quick to realise the immense advantages of a set that has been designed not just by one group of individuals, but by a galaxy of the country's technical brains which has no equal the world over.

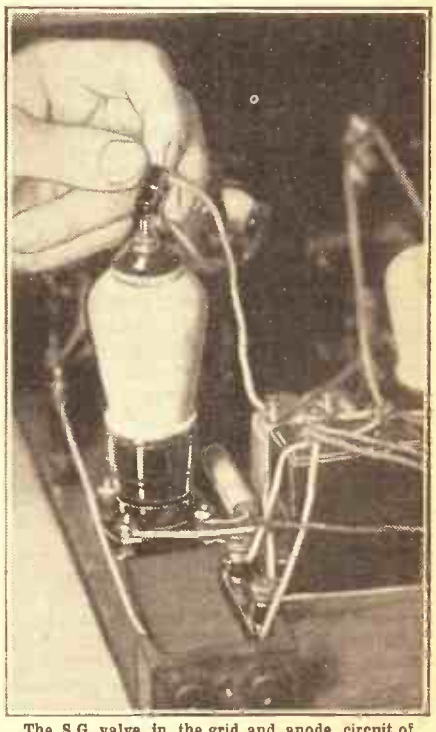
The British radio component manufacturers, always well to the fore, have this time excelled themselves. By the sane adoption of a fearless policy of co-operation they have produced a set which will go down in radio history as the set which made the new wavelength plan practicable. What greater substantiation is needed other than the reputations of the firms whose names are associated with it?

It is very gratifying to us, and it must be more so to them, that the nation-wide response to their efforts has been so spontaneous and so very enthusiastic. It exemplifies the tremendous confidence which home constructors generally place in the industry as a whole and in the recommendations of "P.W.," and it is certainly conducive to further effort on their part in the future.

The Demand for Components.

On the merit of the design alone it was anticipated that the demand for parts for the "Bifocal Three" would be a heavy one, but that it should have been so phenomenal in so short a space of time is a surprise to everyone. The manufacturers are working hard to keep pace with the demand and to ensure that there are no delays; but if you have not yet ordered your parts you would be well advised to do so *now*.

HIGH INITIAL AMPLIFICATION



The S.G. valve, in the grid and anode circuit of which the Bifocal coils are placed, is here shown with an anode connector being placed in position. It is this valve and its associated circuits that ensure the set its magnificent range of reception.

It is certain that, if the present phenomenal demand is maintained for many more days (and there is every indication that it will be), existing stocks will rapidly be exhausted, in which case you may have to wait some little time for supplies.

But why risk disappointment? Sooner or later you will have to depend upon "focused" radio if you want interference-free programmes, so why not begin to enjoy the advantages now? You can't go wrong with the "Bifocal"!

What They Say of the "Bifocal Three"

Mr. J. M. Rees (Varley).
". . . . I regard it as a tremendous step forward towards the long-sought-after ideal of interference-free radio . . ."

Mr. A. F. Bulgin (A. F. Bulgin & Co., Ltd.).
". . . . I can definitely say that the "Bifocal Three" is the best three-valve set I have yet heard . . ."

Mr. L. Smith (Benjamin Electric Ltd.).
". . . . Focused radio is one of the greatest developments since the valve. There is little doubt that on merit alone the "Bifocal Three" will achieve tremendous popularity, and I regard it as the most telling answer to the new wavelength problem. . . ."

Mr. W. Fillmore (Jackson Brothers).
". . . In my opinion, the "Bifocal Three" is a set which makes radio history. The tremendous advantages of this great new system will rapidly establish the set as a firm favourite with home-constructors the world over . . ."

Ferranti Ltd.
". . . The "Bifocal Three" appears to be a receiver simple to construct and of advanced design, and should have a wide appeal to the intelligent constructor requiring to build something out of the ordinary. . . ."

THE MIRROR OF THE B.B.C.

EUROPE'S BROADCASTERS FOR LONDON

Daventry's Reception in South America—Time Allotted to Television—In the Air with Hitler, etc.

REFLECTIONS BY O. H. M.

THE annual meeting of the "U.I.R." —the International Union of Broadcasters—will be held in London in June. About 150 delegates are expected, representing all European broadcasting authorities, including Soviet Russia. The B.B.C. is making elaborate plans for the entertainment of the gathering. There will be a number of banquets and luncheons, the Government, the G.P.O. and the wireless industry co-operating to make the festivities successful. The "Union" has not met in London in plenary session since it was formed in 1925.

"Versailles and After."

The summer term of talks contains a promising series with the title "Versailles and After." This will be introduced by Lord Riddell in a reminiscent address on April 9th. Professor C. K. Webster and Professor Arnold Toynbee will continue the series.

Malcolm Frost Back.

Mr. Malcolm Frost, the B.B.C. "traveller," is back from his visit to America, where he has been trying to arrange for the sale of recorded B.B.C. programmes. I hear he has had many interesting experiences and has done some good business. While in Canada he was consulted unofficially about many of the problems that confront the Canadians in evolving their new national system of broadcasting.

In New York Mr. Frost was well received both by the N.B.C. and C.B.S., and his efforts continued the task of cementing the practical liaison between the B.B.C. and its opposite numbers on the other side of the Atlantic.

B.B.C. Chairman in South America.

The Rt. Hon. J. H. Whitley, Chairman of the B.B.C., now on his way to South America, will examine on the spot the degree of popularity of the B.B.C. short-wave service. Broadcasting House has received an encouraging volume of correspondence from British residents in South America, where several local stations regularly relay Daventry. Mr. Whitley, although primarily on a health cruise, will investigate conditions both in Brazil and the Argentine.

Television Doubts.

With March 31st approaching the B.B.C. has further doubts about the future of television transmissions. It was intended to replace the four half-hours weekly by two periods of about fifteen minutes each; but even these are now in danger.

The truth appears to be that engineering opinion, both in the B.B.C. and in the Baird Company, is so sceptical of low-definition methods that the authorities may abandon it altogether. It will remain then to decide if and when anything is to be done about high-definition transmission for public use. One satisfactory aspect of the situation is that there is no longer conflict of qualified engineering opinion.

The B.B.C. Bends.

Although Broadcasting House makes a brave appearance of ignoring what it describes as "malicious and ignorant criticism," meaning by this everything unpalatable, some notice is being taken of the new campaign in a section of the popular Press to lighten the programmes. Any way, I can say with confidence that the Sunday offerings are to be definitely less serious.

Music will be lighter and there will be less serious talk. Unfortunately, there is no sign as yet of a change of heart on alternatives in the big sense. To put on plays for three-quarters of an hour of the weekday dance period will satisfy few.

A MODERN PIED PIPER.

Lance Sieveking rehearsing some of the children who took part in the recent broadcast of "Emil and the Detectives."

Flying with Hitler.

The first foreign observer to be invited to fly with Hitler, after he became Chancellor of Germany, is to give a talk on The Continent To-day, for inclusion in the West Regional programme on Thursday, March 15th.

Unfortunately for most listeners, Mr. Gareth Jones will speak in Welsh, but he could just as easily give his talk in Russian or German, for which languages he took first-class honours at Cambridge.

Mr. Gareth Jones flew with the Nazi leader on his aeroplane election campaign a few days after Hitler became Chancellor.

A Midlands Play.

An office boy who "gets his own back" upon his employers for nothing more important than "giving him the sack" (which he probably deserved in any case) begins the story upon which a new comedy called "Our Gramophone Shop" has been founded by Laurie Devine and T. W. Rees.

Martyn Webster is to produce the play for Midland Regional listeners on Thursday, March 15th, with a cast that includes Hugh Morton, Alma Vane, Harry Sexton and H. Raymond Smith.

The revengeful office boy has a nice little game of changing a stock of gramophone records from their right to their wrong covers. You can guess what happens when the vicar, wanting a suitable disc for the entertainment of small children, is handed a record of a comic song dealing with the delinquencies of the "missus," and a politician, seeking material for a speech on the Far East, gets a sample of funny talk between some Irish comedians. The possibilities of such a theme are adequate for a good comedy, all through the piece to the usual happy ending, which is brought about by the introduction of a great theatrical producer.

(*Continued on page* 1129.)

THE LISTENER'S NOTEBOOK

Comment and Criticism on Programmes and Artistes.

"LOYALTIES" was a great success, especially the B.B.C.'s part in it. It is interesting to note how easy it was to follow, despite the large cast. I am not certain whether this is due to our being more experienced listeners now or whether the B.B.C., by some technical arrangement, is facilitating listening-in.

Whatever the case, the fact remains we can now listen to a large cast without confusion. Ernest Milton, of course, has a very distinctive voice, quite unique among radio actors.

* * *

All the parts were well drawn—with one exception. The police inspector's interpretation of his part was wrong. Police inspectors do *not* talk in such a tone—not even in Newmarket. There were other weak spots in the play, too, but the fault did not lie with the B.B.C.

Didn't it strike you as strange that big racing men—the leading characters in the play—should be in a London club on the day of a big race? And they were even made to inquire of a waiter what had won. Didn't Charles Winsor *own* a house only four miles from Newmarket? It is indeed hard to imagine these people missing the last big day at Newmarket!

* * *

This wasn't the only blemish. What about the numbers of the stolen notes? Apparently these numbers are first given to the public when the case is tried—months after the theft. And yet they were immediately obtained from the bookmaker who paid Levis. Why, the first thing the police do is to make public such numbers, if known! And they were known. Didn't it also strike you as remarkable that the man who had these notes should have seen the numbers as given out in court and still be in possession of the notes?

* * *

And wasn't the whole business of solicitor and counsel rather ridiculous? What counsel goes off to Brighton without talking things over before he goes? And the Jew going to Dancy's solicitor! These are details, perhaps, but they can't escape criticism.

* * *

Mr. James Douglas truthfully said that whereas an event often makes news it seldom makes history. In which category of events are we to place his talk in the "Seven Days' Hard" series? We are familiar with Mr. Douglas' writings. We know his fearless outspokenness. Now we know that he talks as fearlessly as he writes.

How he must have impressed his millions of listening Lords, Ladies and Gentlemen! A unique salutation this, by the way. King Albert's death, he said, shook the world with awe because it was a solemn message to an agonised Europe—it was a solemn warning to a doomed world. King Albert had already saved Europe once. Will his death save Europe a second time? Great words, these!

(*Continued on page* 1129.)

PROGRESS IN TELEVISION

A NEW SCANNING SYSTEM

By Dr. J. H. T. ROBERTS, F. Inst. P.

TELEVISION systems have been broadly classified into two main categories, according as they employ mechanical or electrical "scanning."

The first system generally uses some form of rotating disc or cylinder, with perforations, mirrors, lenses, etc., whilst the second depends upon the use of an electrical beam, such as the cathode-ray stream in an oscillograph tube, the shifting movements of the beam, for scanning purposes, being brought about by variations of electrical potentials upon a system of deflecting electrodes.

The Usual Method.

The picture—say at the reproducing end, for simplicity—is built up by the spot of light which flies over the "lines" from one end to the other and progresses from one edge of the picture to the other, starting again when the complete picture or "frame" has been scanned and repeating the process perhaps 12, perhaps 25 times per second.

A simple illustration may be taken from the way you read a page of print. You start at the top left-hand corner, go along a horizontal line, then back to the left-hand end of the second line, across the page, and so on, gradually coming down the page, line by line, until you have "scanned" the whole page.

This is precisely how the exploring spot scans the televised picture, but it goes over the whole process in one-twelfth or one-twenty-fifth of a second.

Now, in order to build up a picture at the receiving end the light must vary at the different parts of the picture corresponding to the light and dark parts of the transmitted picture.

In general this is brought about by making the strength or "intensity" of the scanning-light beam vary according to its position. When it is at a point where the original picture is dark its intensity will be diminished, so that it will reproduce a relatively weak or "dark" part on the received picture, whilst at a bright part its intensity will be increased and it will bring up a bright part in the received picture.

The foregoing is known as the "intensity modulation" system.

Velocity Modulation.

More recently, however, a new system, known as "velocity modulation," has been introduced, and it appears to have certain very important advantages over the previous system. But first let me tell you what the method is.

Let us suppose that the traversing spot—say in building up the received picture—remains of *constant brightness* but travels over the lines with *varying speeds*. (You will remember that in the previous system it travels at *constant speed* but varies in *brightness*.)

Then, clearly, the apparent brightness at any point of the picture will depend upon the speed with which the light spot is travelling as it passes over that point.

Television is still liable to surprising developments, and here are details of a completely new departure in scansion which holds great promise of brighter pictures and more detail. Read what our popular contributor has to say about this interesting innovation.

If it is travelling fast the eye will get the impression of less light, whilst if it is travelling slowly the spot in question will appear brighter. It is evident that the maximum possible brightness would be seen if the light spot rested stationary at any point of the picture.

THE PICTURE ON THE TUBE

An untouched photo of the end of a Cossor cathode-ray tube—like the one in the heading picture—showing how the televised picture appears on the fluorescent screen.

In practice the brightness, even at the brightest parts of the picture, will always be less than this optimum value. In fact, the apparent brightness at any "element" of the picture is proportional to the time taken to traverse the element; that is, it is inversely proportional to the local instantaneous scanning velocity.

This principle, then, presents the possibility of obtaining light and dark in a received picture without actual modulation of the spot or ray intensity. It would appear, therefore, to be ideally suited to television reception by means of the conventional cathode-ray oscillograph.

Incidentally, the cathode-ray oscillograph is practically the only instrument which has sufficient freedom from inertia to respond successfully to the extremely abrupt changes of velocity which are called for.

Cathode-Ray Transmitter.

The scanning at the transmitting and receiving ends must, of course, be velocity modulated in both cases, which means that a cathode-ray tube must serve as a source of light at the transmitter.

The problem, then, becomes as follows: To make the spot of an oscillograph illuminate say, a cinema film point by point (through a lens), the light transmitted through the film falling upon a photo-cell, and to cause the output from the photo-cell to *react* back on the scanning oscillograph in such a manner as to control the instantaneous scanning speed.

In the case of a "positive" picture increased light must cause a decrease of scanning velocity and vice versa.

As a result of this arrangement a copy of the picture appears on the transmitting tube itself.

A curious and important feature of the system is that the transmission problem is reduced to that of tying the deflector plates of the receiving oscillograph in parallel with the corresponding plates of the transmitter. If this is done the question of synchronisation does not arise; the synchronism of the system is, in fact, *implicit*.

In actual practice, in order to use a single-channel transmission, this implicit synchronism is retained only in the *line*-scanning direction, the synchronism in the *picture*-scanning direction being achieved by means of a signal impressed on the line scanning.

Main Advantages.

The principle thus offers two main advantages: (a) Absence of synchronising problem, at least in the line-scanning direction; and (b) absence of intensity modulation of the cathode ray.

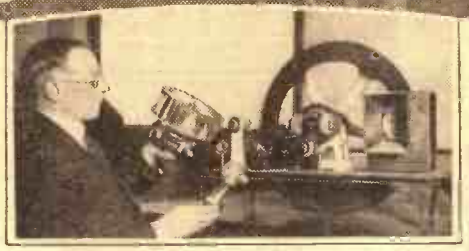
In addition the system gives (c) increased brightness for a given receiving oscillograph; and (d) concentration of detail in the light positions of the picture.

This new system appears to mark a very important step forward in television progress, and its remarkable and rapid developments are due to the skill and enterprise of Mr. W. R. Bullimore, head of the Cossor Valve Company, and Messrs. L. H. Bedford and O. S. Puckle of the same company.

TELEVISION

BY G. P. KENDALL B.Sc.

THE MIRROR DRUM IN PRACTICE



Highly interesting is this account of the practical aspects of mirror drum working, in which we read how a flying spot of light is made to scan the television receiving screen. It also explains the cause and cure of those dark lines that sometimes mar the picture.

HOW TO OBTAIN THE BEST RESULTS

I HAD to leave the mirror drum rather abruptly last time, because I had not noticed that I was so near the end of my space. However, I had explained the general principles on which it works, and now we can turn to the more practical matters of its use in an actual viewing system.

A practical point which may have struck the reader as presenting some slight difficulty concerns the setting of the little mirrors at the exact angles needed for the purpose. Under working conditions, however, the matter is comparatively simple.

The mirrors are usually mounted so that the angle at which they are set can be varied by means of some sort of screw adjustment. This makes it quite easy to set them correctly by trial and error if the drum is turned slowly by hand and the path of each spot of light is traced out and checked as it crosses the screen.

Not a Difficult Task.

All that one has to do is to attach a piece of white paper to the back of the screen, and then turn the drum slowly until a spot is seen to sweep down the edge of the picture area.

The edges of the track of this spot are marked out with a pencil, then the drum is turned to bring the next spot on to the paper, and the track of *that* one is checked. If it does not fall exactly alongside the pencilled path of the first one, without overlapping, the mirror setting is adjusted until it does.

As soon as number two is correctly set attention is turned to number three, and so on until the whole lot have been adjusted. It is a process calling for some patience and care, but, as the reader will see, there is really no very great difficulty about it.

All the same, I must not give the impression that because the job is quite straightforward it should lightly be undertaken whenever the user thinks it might perhaps improve the picture. The fact is that it is only simple if one sets about it very carefully and without the slightest hurry; if one is not prepared to spend an hour or so on the task it is far better to let it alone.

Those Black Lines on the Screen.

Fortunately, the need for such adjustment is rare if the drum is properly treated, and, still more fortunately, when the need *does* arise a clear warning appears on the screen. This takes the form of one or more dark lines running vertically on the picture, always in the same place.

Unless such lines appear and are seen every time you use the drum, quite regardless of the nature of the picture being received, you can safely assume that the mirrors are correctly set.

To return to more general matters, it is to be noted that the mirror drum system is essentially one for the projection method of reception, in which the image is made to appear on a screen, usually of ground glass. It is most commonly used, therefore, in combination with one of those light-modulation systems which provide a large volume of illumination.

In the majority of cases this takes the form of a fairly powerful lamp of the projector or concentrated-filament type, with light control by a Kerr cell, or the Okolicsanyi device in which a piece of mineral crystal replaces the nitro-benzol condenser.

With an assembly of this type it is possible to obtain a really well-illuminated picture three inches by seven without the use of any "unfair aids" in the way of magnifying lenses. This, in other words, is the actual size of the screen which is covered by the scanning spot.

How it is Arranged.

I am referring here, by the by, to results under amateur conditions. It is *possible* to get considerably bigger pictures by the use of larger powers at certain points, but the size I have mentioned is quite easy and indicates the notable merit of the mirror drum as a scanning device.

As a matter of practical interest, I am giving this week a diagram of just the essential optical features of a mirror drum viewer. In this you will note that as much as possible of the light from the projector lamp is gathered up by a condenser lens and focused down to a fine pencil in order that it may get through the small opening in the light valve. After getting through, of course, it is what is called a "diverging beam," because it was brought to an actual point in the Kerr cell.

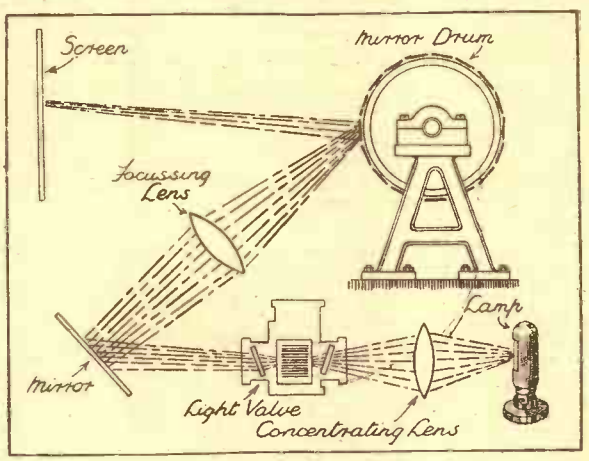
Another lens is provided to deal with this state of affairs, and this turns the beam into a converging one again. As a result, the rays are brought down almost to a point on the screen, and the consequence is a very bright spot of light thereon.

The Spot Must be the Right Size.

The exact "power" of this lens, by the way, in combination with its position in relation to the screen, has to be so chosen that the spot is of just the right size; if it is too small there will be spaces between the lines it draws on the screen, and if it is too large there will be overlapping.

I think the rest of the diagram will explain itself, in the light of the knowledge of principles we have now acquired. Just one point may seem a little puzzling, perhaps, and that is the apparent need for the extra mirror.

As a matter of fact, this mirror is not necessary at all, but it is usually put in to represent a means of taking the beam of light to various parts of the apparatus without having to lay it all out in a straight line.



AT THE RECEIVING END.

The path of the beam of light from the time it leaves the lamp until it reaches the television screen is illustrated diagrammatically above.

In the picture below we have a close-up of a Baird mirror drum, showing the device for automatic synchronising in the foreground.

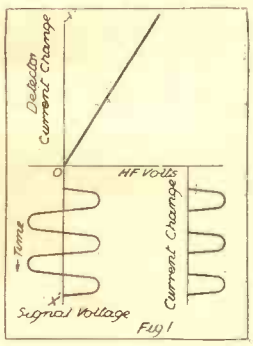
" What is demodulation ? " asks a reader who requires of our Chief Radio Consultant an explanation of how a detector can make a difference to selectivity. So this article shows the effect that the carrier of a strong station can have upon the elimination of many forms of common interference.

VERY few people seem to know why a detector should have a straight-line characteristic in one case and a square law in another. I sometimes wonder if I know all about detectors myself !

But someone asks: "What is demodulation ? Will you explain it to us ? I am sure there are a great many, like myself, who would like to know why a detector, of all things, should assist one to have a selective receiver."

It is a little puzzling at first. But then selectivity is dependent upon a great many factors. If you would like to read a really comprehensive survey of the subject, read

STRAIGHT LINE



In this diagram P. P. Eckersley has plotted the volts of high-frequency signal against the change of anode current in a "straight-line" detector valve. Although in practice we hardly ever find a really straight-line detector, P. P. E. has drawn one here for the sake of argument.

an article that was published about a year ago in the I.R.E. Journal and called "The Required Minimum Separation of Frequencies between the Carrier-Waves of Broadcasting Stations."

You will there see it explained how high-frequency-band width of transmission, high-frequency-band width of reception, relative strengths of transmissions on neighbouring channels and detector characteristics and low-frequency response are factors which all, to a greater or lesser degree, govern selectivity.

The Old " Wipe-Out " Effect.

But detector demodulation is an important factor. We used to call it " wipe-out." You could have a receiver ready tuned to a transmitter and yet hear jamming, cracklings and all sorts, when, if the transmitter-carrier was switched on all became silent, hushed and expectant.

Then the voice blew one's head off. The " wiping out," due to the carrier, was noticed by everyone and explained by some, but not until lately has the effect been dignified by so elevating a name as " demodulation." But it's time to explain it and not to talk about it so much.

Consider, first, a " straight-line " detector. That is shown in Fig. 1. The volts of high-frequency signal are plotted against, say, the *change* of anode current in a detector valve. We never get a quite-straight-line detector: there's usually a bend at the bottom of the characteristic (characteristically called " the bottom bend "). But, for the sake of this argument, we talk about a straight-line detector when it has a characteristic as I have drawn it in Fig. 1.

What Rectification Does.

First of all, consider what happens when a strong signal comes along. The signal can be shown plotted against time as a sine curve, disposed about the line X O X¹. When the voltage excursions go to the right of the line, then they cause current to flow in the valve anode circuit. We may thus draw another half-sine curve, as I have shown it, to represent detector current.

These unidirectional pulses of current represent the state of affairs for a steady carrier-wave. If the intensity of the carrier-wave is increased and decreased (modulated), then the unidirectional impulses increase and decrease in sympathy with these modulations, and so we have distortionless rectification—i.e. one half of the signal is cut off and the unidirectional pulses increase and decrease at audio-frequency. All this is well known and straightforward.

But now let us turn to Fig. 2. Here a weak signal, of different frequency from the strong signal, gets into the detector (because, perhaps, the predetector high-frequency tuning circuits were not sufficiently selective to cut out all of the unwanted signal).

Without going too deeply into it you will readily see that, because they are of different frequencies, the signals will add together at one time and at another they will subtract.

Riding on the Peaks.

But the weak signal, riding upon the peaks of the strong signal along the *straight* detector curve, *will not get rectified*. After all, the process of rectification is to cut off one-half of the high-frequency signal. This only happens if the signal is varying about the line X O X¹. But, because we have a strong signal, and because the weak signal rides on top of the strong signal, it does not vary around X O X¹. It, in fact, makes rectified current changes as much upwards as downwards. So the weak signal does not get rectified, and, of course, if you do not rectify a signal you do not hear it. So the weak signal is " demodulated " by the strong.

This is the very simple theory, but it is not quite complete. Because, of course, if you plot it all out very exactly, there are times when the weak signal falls in the trough between the peaks of the big signal and a little of it gets rectified.

But you need not worry about this, which is, so long as there is a 3 or 4 to 1 difference between strong and weak signals. a secondary effect. What you have seen, and what is important to see, is that the wiping out or " demodulation " of the weaker signal can take place, provided you have a straight-line detector.

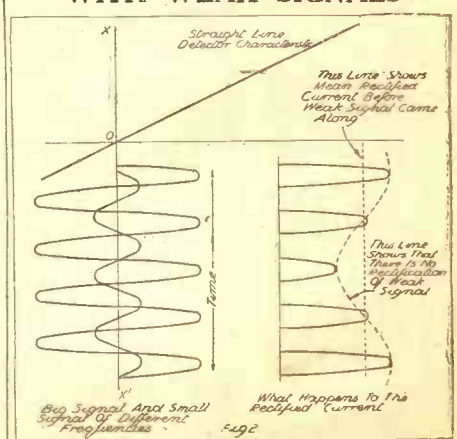
Importance of Linear Response.

If this effect was not, in fact, present more or less in all receivers we should complain about the Lucerne Plan more than we do. It is, therefore, very important to ensure that detectors give linear response.

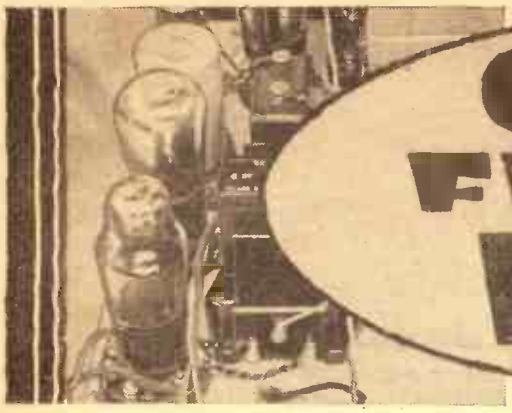
You will appreciate that any departure from the linear law means loss of selectivity. If the wanted signal is too strong and the weaker and unwanted rides into curved parts of the detector characteristic, loss of selectivity will be bound to occur.

It is interesting, finally, to observe that in the first detector in a superheterodyne you do not want demodulation, because, if you had it, you would not get any intermediate frequency.

WITH WEAK SIGNALS


Straight Line Detector Characteristic
This Line Shows Mean Rectified Current Before Weak Signal Came Along
This Line Shows That There Is No Rectification Of Weak Signal
Time
Big Signal And Small Signal Of Different Frequencies
What Happens To The Rectified Current
Fig 2

Showing how a weak signal, of different frequency from a strong one, will not be rectified if both of them find their way into the detector at the same time.



CLASS B FROM THE MAINS

THE "economy push-pull" output circuits known as Class B and Quiescent Push-Pull enable the H.T. battery user to obtain a large power output. At the same time they enable the H.T. consumption to be much lower than if a super-power valve is used.

Those fortunate enough to have A.C. mains supply can obtain the same or greater output at fairly low cost. The D.C. mains user is in certain ways at a great disadvantage.

When heavy variations of anode current are demanded by a set operating from the mains—as in the case of Class B—care must be taken that the H.T. voltage supply is kept constant. The degree to which constancy can be attained depends upon the design of the power pack, though, if this is initially unsuitable, slight alterations can be made in some cases to overcome the trouble.

No doubt there are many D.C. mains users who would use a Class B or Q.P.P. output stage if it were not for the fact that an ordinary H.T. eliminator is unsuitable. With Class B or Q.P.P. the anode current varies in sympathy with the strength of the signal received.

Voltage Regulation.

For example, when no station is tuned in or there is an interval in the programme the output stage is "quiescent." This means that it is not actually doing any work, and in these circumstances the anode current taken by the stage is very low, 3 to 5 milliamps being an average.

On the other hand, when a large volume is delivered, as when reproducing a heavy orchestral passage, the current rises momentarily, possibly up to 30 or 40 milliamps.

It is obvious that an H.T. supply for this output circuit must have good voltage regulation. Unfortunately, most H.T. units are not comparable in this respect with a dry battery or accumulator.

In addition, many H.T. units are not capable of supplying the peak anode currents required by Class B without the smoothing circuit becoming momentarily ineffective.

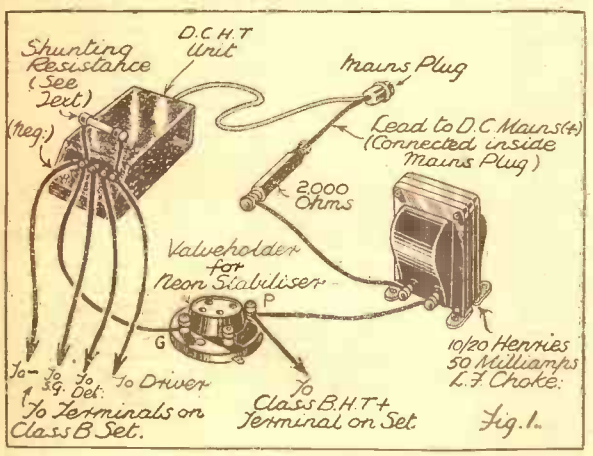
However, those who have D.C. mains units giving 15 to 25 milliamps, which are intended for use with a normal set, can sometimes supply H.T. to a Class B stage in the following manner:

The majority of H.T. mains units have the smoothing choke and any voltage-reducing resistances in the positive side. The negative output terminal is connected directly to the negative side of the mains input to the eliminator.

Providing this is the case, a separate positive H.T. lead can be run from the positive mains input of the H.T. unit to the Class B stage, as shown in Fig. 1.

A 2,000-ohms resistance and an L.F. choke are provided for smoothing and voltage dropping. A Cossor neon voltage stabiliser plugs into the standard four-pin valve holder shown.

EASILY ADAPTED FOR CLASS B



Showing how a "small" mains unit designed for 15-25 m/a outputs can be adapted for Class B work, complete with voltage stabiliser.

The Stabiliser.

This neon voltage stabiliser is designed to take current in inverse proportion to a Class B or Q.P.P. stage. Therefore, when the Class B valve anode current is low, the neon takes a fairly large current and stabilises the H.T. voltage. By this means the H.T. voltage applied to the Class B stage is kept constant at about 130 volts.

It was mentioned that this arrangement can only be used when there is no resistance or choke in the negative lead of the H.T. unit. If it is not possible to obtain confirmation of this point by examination or inquiry a test may easily be made.

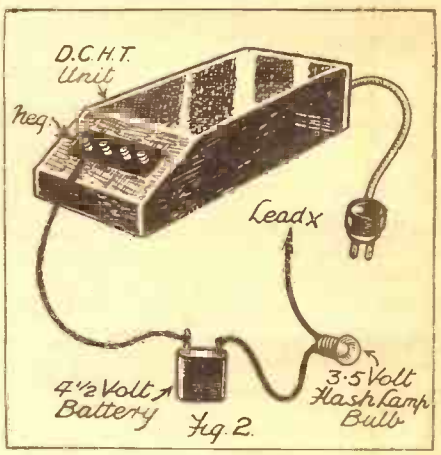
A 3·5-volt flashlamp bulb and a 4½-volt battery will be required.

The H.T. unit should be disconnected from the mains and the set.

The flashlamp bulb and battery should then be connected, as shown in Fig. 2. When the lead marked X is connected to one of the mains plug pins the flashlamp bulb will not light. This is the positive mains lead, and this mains plug pin should be marked. This marking will prove of assistance when connecting the extra resistance, choke, etc.

Now the lead X should be pressed against the other pin of the mains plug. If the bulb lights, this shows that the negative connection of the H.T. unit has little or no resistance in circuit.

CHECKING THE CIRCUIT



Testing a unit to determine if a resistance or choke is incorporated in the H.T. negative side of the circuit.

Shunting Resistance Values.

In this case the H.T. unit is quite suitable for the modified arrangement.

When the unit is used in this way with an ordinary set it will be necessary to connect a resistance across the — and +120/150-volt output terminals to prevent the H.T. voltage rising unduly.

In these circumstances the shunting resistance, Fig. 1, may be 20,000 ohms for a 15-milliamp type H.T. unit, 10,000 ohms for a 20-milliamp unit or 7,000 ohms if a 25-milliamp model. This will prevent the voltage applied to the driver and other valves being excessive. C. R.

ON THE SHORT-WAVES

OUR SPECIAL SECTION FOR SHORT-WAVE ENTHUSIASTS

Conducted by W.L.S.

IN this, the first of our new short-wave sections, I want to start off with a heart-to-heart talk to all those readers who already possess a short-wave receiver. Included in this category there will doubtless be happy readers and miserable ones; successful and unsuccessful ones; and here and there, perhaps, a thoroughly disillusioned man who thinks that "these short waves are all *bunk*."

Right at the outset, if my word counts for anything at all, I want to assure any of these latter that short waves are *not* all bunk. On the other hand, they are at last beginning to assume an air of great importance.

Readers who have tried out short-wave reception and given it up in disgust have possibly been unlucky. They may have been a little lacking in perseverance or (and I hate to say it) they may have been merely stupid.

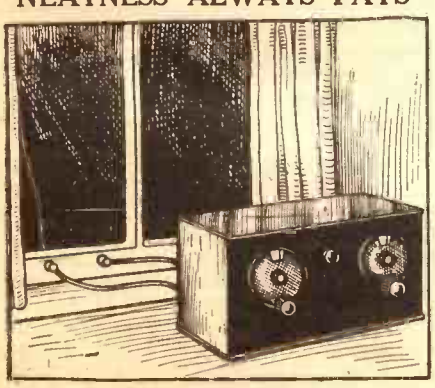
How Does Your Set Look?

I don't think there are many in the last class, but I *have* met them, and I assure my better-informed readers that there is nothing more pathetic than the sight of a not-too-skilled wireless fan trying to initiate himself into the mysteries of short waves without any help from the technical periodicals.

Ask yourself an honest question straight away. Does your receiver look at all like either of those appearing in the sketches on this page? And if so, which?

Tidiness, as I have often said before, is enormously important, chiefly because it induces that frame of mind that makes one look after details. I am not going to harp so much on sheer neatness as on this attention to details, which, taken separately, may seem unimportant. But, oh, how they add up!

NEATNESS ALWAYS PAYS



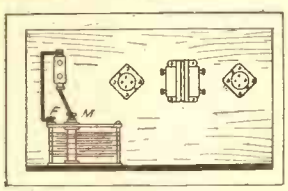
"Tidiness is enormously important, because it induces that frame of mind that makes one look after details."

ABOUT YOUR RECEIVER

Attention to detail is the secret of success in short-wave work, and W. L. S. tells you how to be sure of good results right from the start.

Get rid of that "No. 28 D.C.C. complex." Wire your receiver up with a civilised gauge of wire, and if you don't solder, then for goodness' sake use a pair of pliers to screw your nuts down with (unless you have a "P.W." "multi-tool," which is even better!).

I have had receivers sent to me for test which have literally "come to pieces in me 'and," in the immortal phrase of the lady who "does for one."



Always connect the tuning coil directly across its variable condenser with as short leads as possible.

I don't like blowing my own trumpet, but I wish all my readers who do untidy work could see the trouble I have taken with my present short-wave receiver to make everything really rigid and permanent. It's very well worth it, too, because it has held its calibration to less than 10 kc. for quite a long time.

The "Tank" Circuit.

For instance, I can still tell for certain, by the dial reading alone, whether the station I am listening to is VE9GW on 49·22 metres or W3XAL on 49·18 metres. That, in itself, isn't a tremendously important point, but it *does* imply that the innards of the receiver don't walk about when a lorry goes past the door!

There is one specific point that I must mention once again. As soon as you have read this page, go straight to your short-waver and see whether your main tuning condenser and detector-grid coil are really connected together in the manner shown in the small sketch. This grid coil and its associated condenser should be treated as if it were what amateur transmitters call their "tank" circuit.

Connect your condenser as directly as you possibly can to the coil that it is supposed to tune. Don't have "strange interludes," as a friend of mine calls them. That is to say, don't take your wire from the moving plates to the L.T. — terminal on your valve holder, and just hope that it finds its way round eventually to the earth end of the coil.

Next, refer back to the other diagrams, and reflect upon the importance of being tidy with the *externals* of your set. Battery wires should be of heavy gauge (at least, the L.T. leads should, and the H.T. leads should be well insulated). Take them directly, too. And another important point—don't leave all sorts of junk lying about on the table that your set lives on.

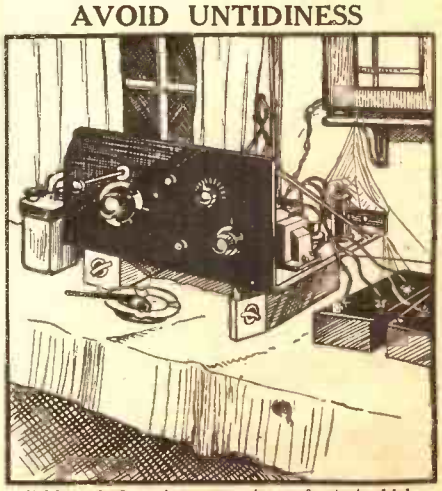
Those Mysterious Crackles.

Many cases of chronic crackles have been traced to something right outside the set, such as tools rolling about on an old aluminium panel, or something of that sort.

Another lesson to be learnt from those two little pictures is in the layout of the panel. Don't use up old holes in the panel and have condensers and resistances flopping about at all sorts of angles.

Well, so much for "How You Do It." Next week I will begin to deal with "What You Do"—which, as I have already hinted, is far less important, provided that you have started on the right lines.

AVOID UNTIDINESS



"I have had receivers come to me for test which have literally 'come to pieces in me 'and.'"

On the Short Waves—Page 2.

WHAT TO SEARCH FOR AND WHEN TO LISTEN

THE majority of readers of these notes will, presumably, not have much opportunity for listening on short waves during daylight, except at week-ends. For that reason it will be best to concentrate on the stations that may be heard during the evening.

The times given should prove fairly reliable from now until about the middle of May.

Between 6 p.m. and 8 p.m. it should be easily possible to log Nairobi (V Q 7 L O) on 49·5 metres. Daventry (G S A), on 49·59, will probably be picked up first, and should serve as a useful guide.

Plenty to Pick Up.

There will be very little else of any particular interest on the 49-metre band at that time of the evening, but on the lower bands there is usually plenty to look for. W 2 X A D and W 8 X K, on 19·56 and 19·72 metres respectively, should be coming over well until a later and later hour each day. W 8 X K, on his other wave—25·27 metres—should be even better and last even longer.

On the 31-metre band there are three fairly reliable Americans at the present time—W 2 X A F (31·48); W 1 X A Z (31·35) and W 3 X A U (31·28). The Empire station G S B is just above W 2 X A F, while G S C is between W 1 X A Z and W 3 X A U. It is worth one's while to find out definitely whether G S B or G S C is transmitting at the time, as they, like G S A, make very useful "pointers" in the 31-metre band.

Round the Other Side.

Sydney (V K 2 M E)—the most distant station that many readers of "P.W." will ever hear—is rather an uncertain quantity nowadays. The best time to look for him, definitely, is on a Sunday morning between 6 and 8 a.m. If conditions happen to be good for Australia he will probably be heard as late as midday, but at a greatly reduced strength by then.

It is a well-known phenomenon among short-wave enthusiasts that, once one has picked up some particular station for the first time, one seems to be able to find him whenever one wants to.

Once you have acquired the knack of finding Sydney, and logged his dial reading accurately, you will find it possible to tune him in regularly week after week. No prize is offered, but we should be interested to hear from the reader who can claim the longest unbroken "innings" on V K 2 M E.

Late at night, of course, the easiest stations to receive, and the most consistent, are the various Americans between 46 and 50 metres, including some stations on the north coast of South America.

HAVE YOU EVER HEARD HIM?

This is W 1 A R B, an American amateur station at Connecticut, run by Mr. J. S. Buckley.

Bound Brook (W 3 X L), on 46·69, is usually one of the best U.S.A. stations. The other Bound Brook station (W 3 X A L), on 49·18, runs him fairly close. Other easy stations to find are Miami Beach (W 4 X B), on 49·67—just above Daventry G S A—and Cincinnati (W 8 X A L), on 49·5—just below.

South America.

Of the South Americans the most conspicuous is generally H J 3 A B F—Bogota, Colombia—on 48 metres. It is well worth one's while to draw a large-scale graph of the wavelengths between, say, 45 and 50 metres and to plot stations as they are identified. It is then generally possible to identify the others who keep one waiting for a call-sign.

No mention has been made of the Europeans, because they may be had for the asking at practically any time of day.

WHAT READERS ARE SAYING

THIS week I want to deal, in very concise form, with remarks of general interest that I have found in my correspondence. Readers who have confined themselves to queries will be dealt with next week.

R. N. (Topsham) has definitely received the rather slippery C P 5 (La Paz, Bolivia), and has received a verification from them. J. W. (Newtownards) has difficulty in getting W 2 X A F on 31·48 metres, but has heard another American on roughly the same wave that he describes as "very amateurish." He finds Bound Brook (W 3 X L) still the best American.

Another "Bite" Coming.

G. B. (Accrington) is a hardened case who denies that the effects of a bite from the short-wave bug are permanent. He finds that once he has heard all these DX stations, and knows that he *can* get them, he is no longer interested. He says: "I am quite satisfied that if I had the proper components I could get all that you can, so why should I worry?" Never mind, G. B. You'll get another bite later on!

The week's bright idea comes from R. C. W. (Liverpool), who says: "If these short-wave adaptors don't satisfy the high-efficiency hounds, why don't they build a red-hot short-wave set and use a *broadcast adaptor* with it?" This fellow is a martyr to "man-made static," but seems to be resigned to it.

Another quotation: "We have a tramcar depot about 200 yards away, and the drivers seem to pride themselves on the fatness, brilliance and length of duration of their sparks."

What with that and the broadcast set downstairs (1921 vintage), R. C. W. has a happy time. But does he worry? No! Questions next week, R. C. W.

A Good Start.

E. M. A. B. (Clacton) has started on short waves by the simple expedient of removing the coils from an ordinary 0-v-1 receiver and substituting short-wave coils. And he tunes things in without a slow-motion dial! *What* a hand!

He suggests building a small short-waver which can be coupled, via a transformer, to the "pick-up" terminals of an ordinary all-mains broadcast receiver. Excellent scheme, provided the B.C. set has a good volume control. I imagine a 1 : 1 transformer would be preferable to an ordinary L.F. type.

My "Short-Wave One," by the way, appeared on April 16th, 1932. I shouldn't be surprised if a better and brighter "One" were on the way.

A number of readers write to say their friends have been asking them what is the good of short waves when Americans are so easily heard on medium waves. They need not worry; such reception is likely to fade out with the approach of summer, and, anyway, no one can hear Australia on medium waves!

W. L. S.

A NEW and rather interesting transmission is announced from the recently established station, C R 6 A A, in Portuguese West Africa. The wavelength is 41·8 metres, or very nearly the centre of the amateur 40-metre band. Doubtless the usual welter of European amateurs will make things rather difficult, but we may reasonably expect to hear them when conditions are favourable.

And now comes the "Wireless Pioneers' Society." The originator tells me that membership is to be confined to people "who have spent the greater part of their lives at wireless."

Pioneers in every sense of the word are welcomed, but particularly those who have done their little bit to make universal communication possible by helping to develop the short waves.

Technicians, commercial operators, "hams," "DX hounds" and all are eligible, provided that they can prove what the originators term their "senility" in the short-wave field!

The address is M. Mickelson, 3229, Bloomington Avenue, Minneapolis, U.S.A.

EXPERTS INSIST ON 'ATLAS'

for EVERY BATTERY SET

There is an "ATLAS" Unit to convert any Battery Receiver to Mains Operation in a few minutes without alteration to set or valves; giving more power, improved tone, sharper selectivity at one-fiftieth of the cost of dry batteries.

Prices from **39/6** Cash or 10/- down.

TRY ONE ON YOUR SET

Ask your dealer for a free demonstration and send coupon for FREE Booklet to H. CLARKE & CO. (M/CR.) LIMITED, Patricroft, Manchester.

London: Bush House, W.C.2.

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...BECAUSE no other units have such a reserve of power. Voltages are higher, outputs greater, smoothing finer. There is an ideal "ATLAS" A.C. or D.C. Model for *every* type of set—table, console or portable—home constructed or commercial—even "Class B" and "Q.P.P." and 25-cycle models without extra charge. Every designer of note specifies "ATLAS," the only units to win the Olympia Ballot for two years in succession. Scrap your expensive batteries and cut running costs to LESS THAN 1/- a YEAR by following the experts—insist on "ATLAS."

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ASK YOUR DEALER — HE KNOWS

★ POST THIS COUPON NOW! ★

H. CLARKE & CO. (M/CR.) LTD.,
Atlas Works, Patricroft, Manchester.

Please send me a copy of Booklet 87, telling me how to convert my Battery Set to Mains Operation with an "ATLAS" Unit.

NAME .....

ADDRESS .....

.....30/24

SAFEGUARDING YOUR L.T.

Some interesting comments upon battery beads and their effect on the life and trouble-free working of an accumulator.

By "COLLOID."

IN 1901 I installed in a printing firm a rather large storage battery made by a leading British firm. The demands made upon it were heavy; for ten hours a day it was charged at the maximum rate, while practically all this charge was used up during each night.

Yet, in spite of this heavy work, when I left the firm six years later, the battery showed very little wear. There was not much mud at the bottom of the cells, which had never been cleaned out, while the plates were scarcely warped at all.

Such a performance is, of course, unusually good. To what was it due? In each cell was a flattened glass tube containing three glass floats, or beads as they were called

Indicating the Charge.

One only floated when the acid was up to the proper gravity for full charge; another did not sink until the acid had reached the dilution corresponding to discharge; while a third sank somewhat before the previous one, serving the purpose of the yellow-traffic-signal light, warning the user that the danger point was not far distant.

The battery owed its successful working to the fact that the signals yielded by these floats were scrupulously regarded. If, after the cells had been gassing freely for an hour, the full-charge bead did not float, the acid strength was increased until it did, while it was seldom that the "yellow-light" signal was so far disregarded as to allow the discharge bead to sink.

In those days batteries were usually large and costly, and half a guinea for a bead hydrometer was a negligible factor. To-day wireless and motoring have brought about the use of millions of small accumulators, yet the necessity for careful adjustment of the acid has become, not less important, but much more so.

The paste of the old-time plates was simple enough—just red lead or litharge mixed with dilute acid. The chemist to one of our large modern battery manufacturers told me recently that there is now no more happy hunting ground for the research chemist than in the field of battery-plate pastes.

The Importance of Correct Gravity.

Now, each make of plate works best with acid of appropriate gravities, both for the full charge and the discharge points; an acid incorrect by 20 or 30 points may destroy a good battery in a few weeks. Hence it is of the utmost importance that every cell, even of the many-celled H.T. accumulator, should contain beads put in by the maker; but that is not enough.

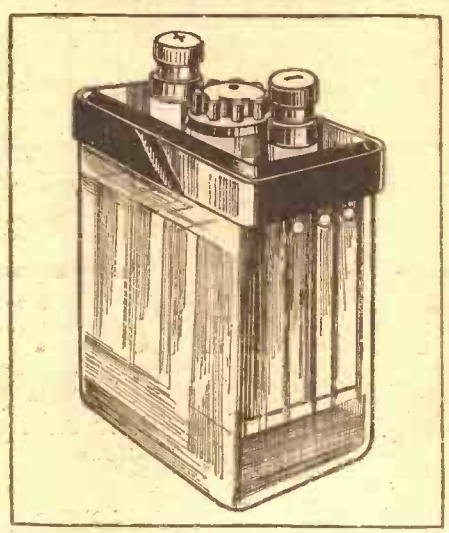
A lady once told me that the bead in her battery worked all right when the battery was new, but that it soon lost its efficiency and never rose upon full charge. No wonder that the battery was worn out and useless within a year! Of course, the truth was that the charging station did not trouble to fully charge the cell; the lady ran it down too low, thus sulphating the plates and causing the acid to become more and more impoverished.

Another user once asked me to test her battery. The acid showed no readable gravity, and I tasted it; it was absolutely plain water.

It is certain that even the poorest make of accumulator on the market, if provided with beads accurately adjusted by the manufacturer, will outlive twice over the most expensive type if the user has not this perfect means of keeping the acid properly adjusted.

Here is an important warning to those who wish to get the best life out of their batteries: never accept the cell from the charging station unless the "full-charge" bead is floating in every cell.

A VALUABLE CHECK



Some batteries have three beads, to indicate the various degrees of charge. By enabling the listener always to keep his accumulator in tip-top condition these beads greatly increase the life of the battery.

Also, if the battery runs out of current while the discharge bead still floats, add water to the cell until the bead sinks before sending for charging; otherwise, the acid being too strong, the cell will be taken off-charge by the bead indication, which in reality only represents partial charge.

The development of the modern battery bead may be of interest to readers. The earliest attempts at making beads cheap enough for small batteries consisted of cores of what looked like pith, covered with a hard layer, apparently of sealing wax. Another early model was just simply india-rubber. Yet another type was frankly candle grease.

It is safe, however, to say that the modern bead is as much a triumph of chemistry as is the present slow-discharge battery plate, and it is covered by many patents.

Here are a few of its essential characteristics:

1. It must be totally insoluble in and unaffected by the acid, even after years of immersion—a feature possessed by no imported bead that I have seen.
2. Its co-efficient of expansion over a fairly wide range must be closely that of the acid.
3. Its surface must have no tendency to hold gas bells adhering to it.
4. It must not become sticky and adhere to the walls of a dry accumulator case, even after prolonged exposure to sunshine in a shop window.

British Beads the Best.

It is a matter of congratulation for the English manufacturer that British beads are the best in the world, that the importation of foreign makes by reputable accumulator manufacturers has ceased, and that there is even some export trade in the British article.

The value to the user of a good bead is so great that no conceivable tariff could keep it out: for I would repeat the advice, which I would impress upon all battery users: Careful respect for the beads put into your cells by the manufacturer will more than double the life of your battery.

GANGED TUNING

Accurate trimming is essential to success in single-dial receivers.

IN these days of band-pass circuits, often with coils of the iron-cored variety, the use of gang condensers is becoming more and more general. And yet, from correspondence received, it would appear that very few home constructors realise the need for accurate trimming or know how to achieve this.

Perfect trimming can only be carried out with the aid of a high-frequency injector and a valve voltmeter, but one can very closely approach accuracy by tuning in a station below 15 degrees on the dial, and trimming to that. If the station happens to have a tuning note so much the easier.

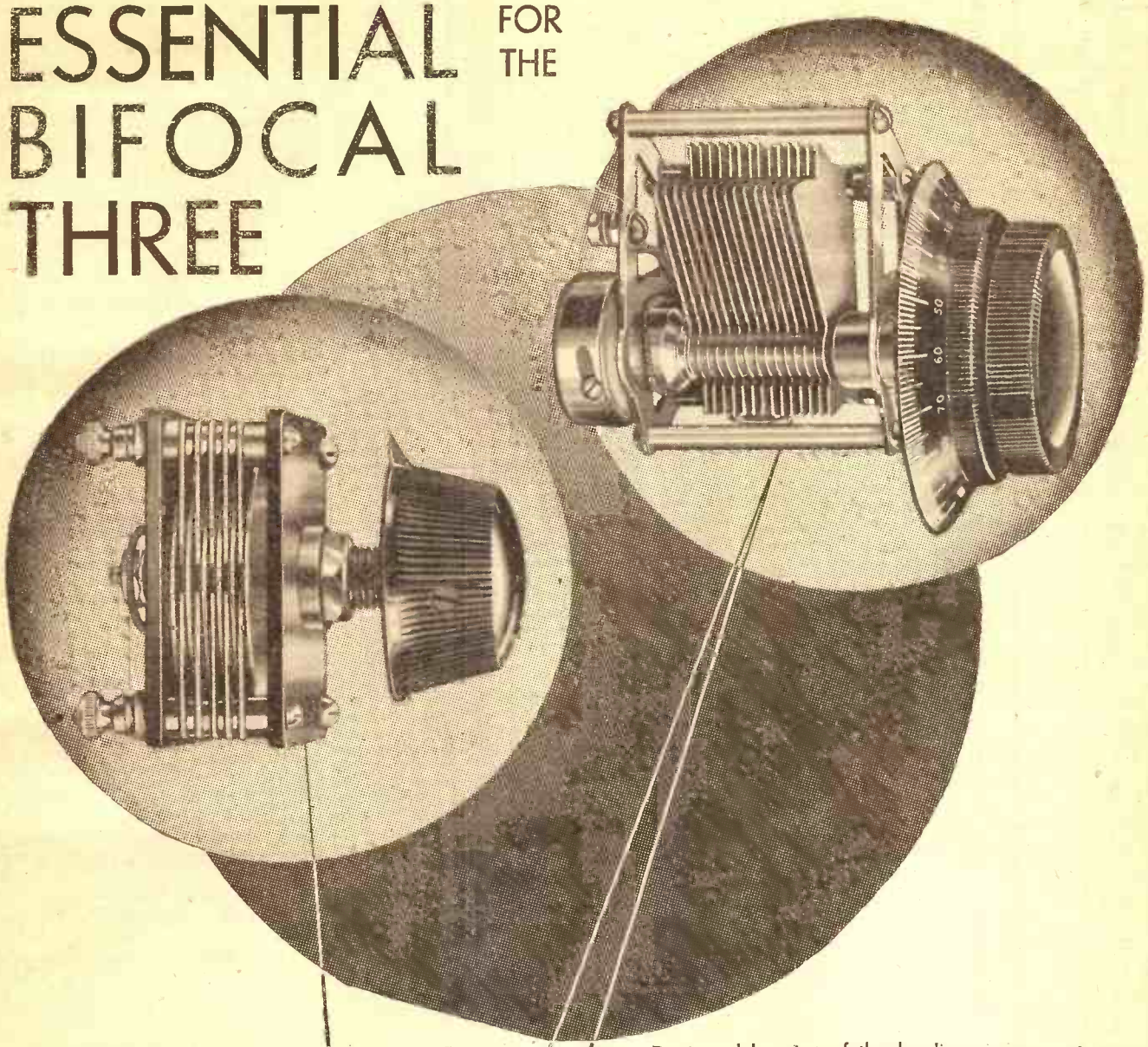
Always aim at achieving the state of "in trim" with the trimmers screwed up as little as possible. The less the capacity added in this way the better will the set keep ganged over the wavebands.

Choose a Weak Station.

The aerial trimming will usually be a bit flat, but other circuits, especially with Ferrocart coils, will be sharply defined in their optimum trimmer settings. First slack the aerial trimmer well back and concentrate on the other one or more, bringing the aerial in trim at the last. The weaker the signal you trim on the better, and if you have to use reaction it's better still: the detector circuit will then show exceedingly sharp trimming.

But remember that not only are well-matched coils and a well-matched gang condenser essential for success, but also a condenser unit free from mechanical faults such as spindle whip or slackness in bearings. Especially is this important where Ferrocart coils are concerned. The condenser *must* be a good one. If it isn't you'll never get it trimmed. D.R.

ESSENTIAL FOR THE BIFOCAL THREE



Designed by nine of the leading component manufacturers—Therein lies the success of the Bifocal Three—Every component used is therefore the best of its kind. J.B. is universally acknowledged to mean complete efficiency and advanced design in J.B.'s special field. The J.B. Popular Logs and Differential Reaction Condenser for instance.

The two Popular Logs are fitted with the J.B. "D" type Slow Motion mechanism. The price complete with 3-inch dial and knob is **7/6.**

The J.B. Differential Reaction Condenser has bakelite dielectric between vanes, which makes short circuit at normal voltage impossible. The price complete is **4/6.**

All Constructors of the Bifocal Three who confine themselves to the specified Components will be guaranteed the results claimed for this wonderful Set.

REG TRADE MARK

PRECISION INSTRUMENTS

Advertisement of Jackson Bros. (London), Ltd., 72, St. Thomas' Street, London, S.E.1. 'Phone: Hop 1837

PRODUCING A RADIO PLAY

The £50 prize offer which POPULAR WIRELESS has made for the best radio play written by a reader before March 31st, 1934, has already produced a remarkable response.

In this article, written by a member of the B.B.C. Productions Department, some more practical help is given to those readers who have not yet sent in their entries.

By
WILLIAM MacLURG

"THIS is the National programme. To-night we are broadcasting a radio play——"

All over the country people settle back in their chairs and prepare for an hour's enjoyment. How many of you ever think of the work which has gone into the production—the casting of the play, the producer's preparations, his conferences with hard-working engineers, balance-and-control experts, studio managers, conductors and effects staff, to whom so much of the success or failure of a production may be due? And then the days and days of rehearsal!

Mixing the Studios.

Let us go through the production of a radio play step by step, as seen from the more technical point of view.

First, the apparatus. We have a number of studios, some designed for music, some for speech, some as special-effects studios, all booked for the production. Each of these studios will be required at some part of the script, or it may be necessary to take sounds from each at the *same* time—music, speech and effects—and mix them together in order to attain a desired composite sound.

In order to mix together the output of all these studios they are linked to a dramatic-control panel. In appearance this is a long grey panel with a rather formidable array of knobs and switches. Separate potentiometers on this panel are connected to each studio, so that they may be faded in or out as required.

The Green Light.

The mixed output from this panel goes to the "B" amplifier, where, too, great variations of strength are levelled out by the man "on control." From the "B," after further amplification, it goes by land line to the transmitters.

The D.C. panel is equipped with a set of switches communicating with green lights in the various studios in use, and by the use of these the actors or singers get their cues. "Speak on a green light," says the producer—that is, when the light in their studio comes on, that is their cue.

Another switch on the panel puts into circuit the "talk-back" microphone in the D.C. room, by means of which the producer may speak to his cast.

The problem before the producer and the technicians working with him is how to make the best use of all this apparatus to attain the results which he has in mind.

At some convenient time a meeting is called, at which all the points are discussed. "An outdoor scene," says the balance-and-control expert. "Don't you think we had best play this in 6B?"—a studio with a very slight echo and giving a definite "outdoor" quality.

"A small room"—this will be played in 6C, a dead studio with no echo and giving the impression of a small, closed space. A third scene, perhaps, is a banqueting hall, and it is decided that 6A would be most suitable for this.

"We'll need artificial echo for this," says the D.C. operator, and so artificial echo is booked in connection with Studio 6A. The types of microphones to be used are discussed and the necessity of using sound-absorbing screens. The effects expert is called upon to give his views of how and where the various effects shall be produced—whether from gramophone records, from an effects studio, or in the same studio as the speakers. Every little point is gone into.

REPRODUCING A STORM AT SEA

The fascination of the B.B.C. Effects Department, with its boundless possibilities for making every imaginable kind of noise, should not mislead intending radio playwrights into thinking "effects" the be-all and end-all of microphone production.

Ready for the First Rehearsal.

The play goes into rehearsal—the first two or three rehearsals will be done in one studio. The producer makes suggestions and works out the characterisation with the cast, instructing them as to which studios they will use, what light cues they will get and so on. Then a microphone is brought into use, and the producer and balance-and-control man between them work out relative positions of players and how to obtain the sounds required. Then comes the first full rehearsal taken from the D.C. panel.

The engineers have connected everything up, as was decided upon at the preliminary meeting; the correct microphone and screens are in each studio; the amplifiers are set at the right strength, and exhaustive tests have been made to ensure that everything is in correct working order.

Fitting in the Programme.

"Stand by, everybody," says the producer through his talk-back microphone. "Everybody in their correct studios—we'll begin"; then to the D.C. operator: "Right; we'll start."

It may be necessary to stop many times to get details right; new ideas may be thought of and applied; the technical details may be altered; but gradually, as rehearsals go on, the thing shapes. It is timed by a stop-watch at a run-through. "Five minutes over; I'm afraid we'll have to cut something," says the producer—the difficulties of programme building mean that the time allocated to a play must be strictly adhered to.

At last the final rehearsal is over. "Fine! Play like that to-night and we'll have a great success"—a smile of satisfaction plays across the probably rather tired face of the producer. "Quarter to eight to-night, everybody."

"All Set" at Last.

A final meeting between the producer and the technicians takes place during the afternoon, perhaps. "I think you had a little too much wind in that storm scene. Keep 6E faded down more"—and the D.C. operator makes a note to this effect. "Can you build up that riot scene more?" the control expert is asked. "Your crowd in 6A was a bit too vigorous," the studio manager is instructed. "Well, keep them all on their toes to-night and it'll be a great show."

Eight o'clock! The cast is all assembled each in his or her correct studio. The announcer stands ready; each expert is in his place. The red lights commence to wink in the studios. Up in the D.C. room warning lights flash up on an indicator to show that all is ready in the studios below. The D.C. operator presses the control-room buzzer and the winking red light becomes a steady glow—the circuit is alive and ready for transmission. The first studio is faded up; a key is pressed; below in the studio a green light glows.

"This is the National programme. To-night we are broadcasting a radio play——"

The MEN WHO RUN the STATIONS

The centralising policy of B.B.C. headquarters has not succeeded in damping the enthusiasm or initiative of the Regional Directors. You will be glad to know something of the principal personalities involved.

BY OUR SPECIAL INVESTIGATOR

THE B.B.C. has itself to blame for the comparative failure of the public to give due credit to the work of the Regions and stations outside London. Although it is true that matter originating in London tends to bulk even in local programmes, it is also true that the Regions themselves are now beginning to contribute more substantially to London programmes.

Despite the centralising policy of headquarters during the past five years, there are still clear signs of much enterprise, ability and originality in the provinces. The gallant staff of the Regional centres, although handicapped by lack of money, have accomplished miracles in programme building. Therefore those who are interested in broadcasting as a whole will be glad to know something of the personalities involved.

THE MIDLANDS

Of course, the most important Region, both in population and in resources, is the North of England, centred in Manchester. There Mr. E. G. D. Liveing, popularly known as "Red Ted," continues to exercise sway as Regional Director for the whole area from Manchester to Newcastle-on-Tyne. There was danger a few months ago that Mr. Liveing would be stolen by the London headquarters, but the prior importance of his work in the North was ultimately recognised. Mr. Liveing is a broadcaster of wide experience, with a valuable literary background. Although born in the South, he is now accepted as one of the leading public personalities of the North Country. Supporting Mr. Liveing there is Mr. Fitch, formerly Director at Glasgow and then at Plymouth. He looks after administrative detail.

The doyen of Regional Directors is Mr. Percy Edgar, an esteemed public personality in the Midland area, for which he is responsible.

An Able Producer.

The programmes are the special concern of Mr. Harding, who is one of the ablest dramatic producers that broadcasting has discovered. It was he who planned and carried out the great Empire Christmas Day programme of 1932. Then there is Victor Smythe, specialising in music. He, too, is well known in the North Country and fully merits his high artistic reputation.

Over at Newcastle-on-Tyne is Mr. E. L. Guildford, who used to be in charge of the Nottingham station, which he took over when Mr. Liveing was promoted to Manchester. Then at Leeds there is another experienced broadcaster in the person of Mr. Fox, the representative for that area.

The Midland Region is captained by Percy Edgar, the doyen of Regional Directors and the Chairman of their Conference. Mr. Edgar, too, has become an esteemed public personality in the area for which he is responsible—that is, from Shrewsbury to Lincoln.

Well Up-to-date Studios.

The B.B.C headquarters in Birmingham are in some respects more up to date in studio arrangements and so on than Broadcasting House itself. Mr. Edgar's keen sense of entertainment values and his intense humanity have stamped themselves so deeply on the programme tradition of the Midlands that he has an appreciative audience far outside his own area.

Mr. Edgar has suffered losses in staff which would have discouraged less stout-hearted people. London stole from him Joseph Lewis, the father of B.B.C. light music, and Charles Brewer, who has a genius for dramatic production of the lighter kind. Recently, however, Mr. Edgar has been reinforced by the acquisition from London of Mr. Victor Hely Hutchinson, who is doing valuable work not only in music generally, but also in surveying and sifting useful local talent in the Region itself.

Down in Cardiff Mr. E. R. Appleton presides over the broadcasting fortunes of Wales and the West of England. Mr. Appleton, in addition to his ordinary B.B.C. work, has become recognised as one of the religious prophets of the post-war period. His "Silent Fellowship" feature, given from Daventry 5 X X, as well as on the West Region, has brought comfort and consolation to many thousands of listeners. His books on religion are read all over the world. His Sunday afternoon feature, known as "Joan and Betty," in which he uses his own family to explain religion to children, is also successful.

THE WEST

Mr. E. R. Appleton, originator of the "Silent Fellowship" and other such programmes, presides over the radio fortunes of Wales and the West of England.

To his other accomplishments Mr. Appleton has added a Welsh bardship, and, as an Englishman, he is extraordinarily popular throughout Wales.

His chief diversion appears to be proceeding rapidly from one place to another in enormous motor-cars, which he drives with exceptional skill. Mr. Appleton has also had his staff raided by London, but, as substantial compensation, has been reinforced with an exceptionally competent programme director in the person of Mr. Sutthey, who has already ingratiated himself not only in Wales, but also in Devon and Cornwall, where, in the past, there has been a feeling of neglect.

Likely to Enlarge.

Down at Plymouth Mr. Parsons, formerly of Swansea, acts for Mr. Appleton. The West Region is likely to require new staff when the contemplated collecting studio is established in North Wales. The purely Welsh part of the programmes has its own staff, the chief personality being Mr. Sam Jones, to whose credit is the "Cobblers" series of programmes which has attracted much interest throughout the Welsh-speaking world.

(*Continued on page* 1129.)

Recommended WRINKLES

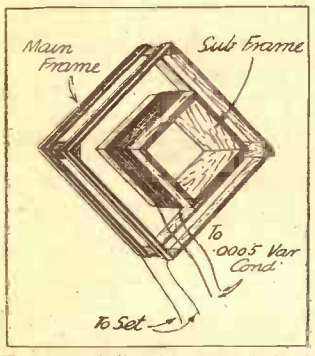
A FRAME-AERIAL TRAP.

WITH a frame aerial, separation of stations in different directions is purely a matter of correcting the direction of the frame.

It sometimes happens, however, that interference comes from a station in line with the one being received.

I have experienced this trouble with a 7-valve superhet with a 22-in. frame.

I have cured it by fitting a wave-trap in the frame, as indicated in the sketch below. Inside the main frame—which is wound in two banks of five turns each side—I have fitted a 10-in. winding of 16 turns of 26-gauge enamelled wire, wound in plane with the main frame.



The new winding is arranged inside the main frame.

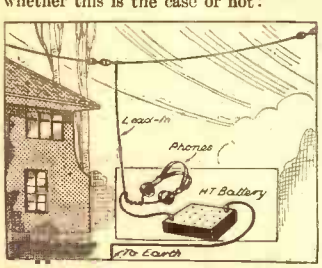
The ends of this sub-frame are connected to a ·0005 variable condenser on the panel of the set, and having no connection with any part of the set circuit.

The small frame tunes practically in step with the main frame, and when rotated to the same dial reading as the main dial will completely cut out any station however strong.

If interference is present I tune in to the interfering station, then cut it completely out by tuning in the wave-trap; then on dialling the station required the interference is eliminated.

CHECK THE INSULATION.

IF absence of results or weak reception leads you to suspect the aerial has a leak or is shorted to earth, the following simple test will soon show whether this is the case or not:



Phones and H.T. batteries are the only two items needed.

Connect one side of an H.T. battery to one tag of a pair of telephones. Join the other telephone tag to the aerial lead-in and the remaining side of the battery to the earth lead. (One has to assume for this test that the earth connection is reasonably good.)

If, on now removing one of the battery plugs, anything but the faintest of clicks is heard, the aerial may be safely assumed to be leaky. A fairly loud click will indicate that it is shorting to earth somewhere.

AN ADJUSTABLE SPANNER.

TO make the device shown, you will require a piece of tool or key steel 1¼ in. by ⅜ in. Saw or file the steel to taper, and then cut the teeth with a smooth file.

Different sized nuts can be handled with this spanner.

TO STOP THRESHOLD HOWL.

SUCCESS in the operation of a short-wave set of the simple single-valve type depends mainly upon a fine adjustment of the reaction control and a condition of operation where the valve is on the "edge" of oscillation.

Unfortunately this condition is not always simple to obtain, owing to an effect which is liable to occur on short waves when the valve goes in and out of oscillation at an audible frequency due to changes in the circuit characteristics.

The effect which is termed "threshold howl" is manifest as a disturbing howl in the earphones.

It is frequently possible to overcome this, however, by a simple expedient. This consists merely of inserting a resistance of about 10,000 ohms between the anode terminal of the detector valve holder and the terminal of the component next in the anode circuit.

ONE GUINEA FOR THE BEST WRINKLE!

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 1s. will be paid for the best Wrinkle from a reader, and others published will be paid for at our usual rates.

Each hint must be on a separate sheet of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear?

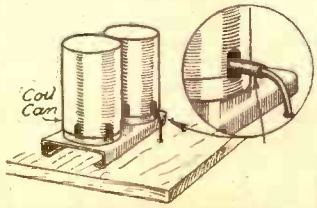
The best Wrinkle in the issue dated Feb. 3rd was sent by Mr. W. H. Grayling, 8, Milton Road, Cambridge, to whom a guinea has been awarded.

SCREENING COILS.

PASSABLE coil screens can be obtained from the cheap stores at a cost of 3d. or 6d., depending on the size required. These screens consist of tin canisters which are made for the purpose of holding coffee, tea, etc. The sizes obtainable should cover practically all the unscreened coils in use, but if they are too big they can easily be cut down with scissors or hacksaw. Ample clearance should be allowed around the coil.

The method best adapted for their use is to stand the coil in the lid of the canister and then screw through the coil on to the baseboard. After the necessary slots have been cut in the body of the canister next the lid coincident with the terminals on the coil for wiring purposes, this can then be placed in position in the lid, and it then becomes a firm fitting. For earthing the screen a hole should be drilled in the bottom of the canister body and a terminal then mounted.

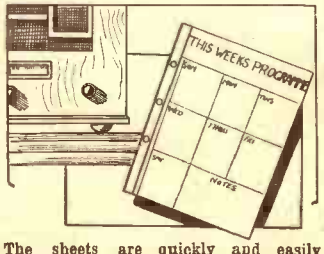
It is possible to obtain aluminium paint at the same stores as the canisters, and if this is applied to the screen it gives a professional finish to the job.



It is advisable doubly to insulate the connections to the coils.

FOR PROGRAMME NOTES.

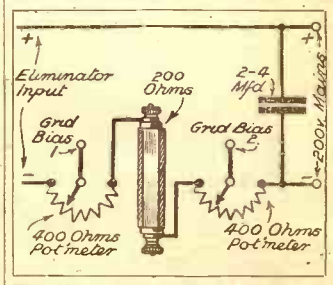
IT has often occurred to me that it would be a great advantage to the listener in general if he had a sheet of paper divided into seven spaces and marked for the days of the week on which could be entered the particular items on the programmes to which he particularly wished to listen. A sheet of the size of the pages of "P.W." is just a handy one for this purpose, Furthermore, as people like to keep diaries, these pages would come in useful and could be bound.



The sheets are quickly and easily ruled up to the desired scheme.

AUTOMATIC GRID BIAS.

BEING desirous of using automatic grid bias on my "Cosmic" Three star model, and being on D.C. mains, I evolved the scheme as in the diagram, and have found it a great success.



This circuit provides two variable grid-bias tappings from the mains.

With 25 milliamps anode current I have 25 volts G.B. available, with two variable tappings, the first giving me about 10 volts and the second from 12 to 25 volts. Where the negative main is earthed and the mains are noisy it may be necessary to make the first condenser 4 mfd. Decoupling for the G.B. taps is, of course, necessary.

STOPPING "PONGING."

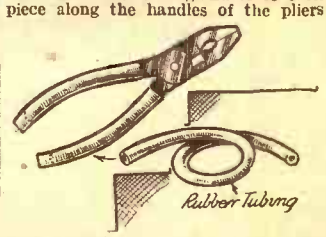
VALVES are by no means so microphonic as they were, and unsprung valve holders are returning to fashion. The result is that when a valve that *is* troublesome in this way crops up, it is not so simply cured.

The following remedy is probably the simplest of all when the set is connected with stiff wire and the valve holder is not sprung:

Simply remove the fixing-down screws for this component, when it will probably lift a quarter of an inch or so above the baseboard and become sprung. If it does not, it is a simple matter to give it a slight pull up, when it will remain suspended by the wiring.

INSULATED PLIERS.

ON rare occasions when the radio constructor handles pliers among live wires, a safe precautionary measure is to obtain two pieces of ⅜-in. inside diameter rubber tubing and force each piece along the handles of the pliers until they almost foul the action of the pliers and, leaving about ½ in. beyond the extremities of the handles, a very effective insulation is provided.



Rubber tubing makes quite a useful insulator for the grips of radio pliers.

BIFOCAL THREE

KIT "A" CASH OR C.O.D. £5 15 0

PILOT AUTHOR KIT EXACT TO SPECIFICATION

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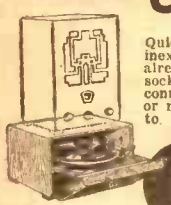

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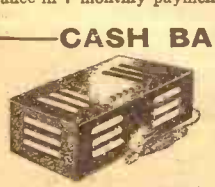

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2	**Bulgin** screened Standard H.F.9 chokes		7	0
1	**T.C.C.** ·1-mfd. condenser, type 250..		1	4
1	**T.C.C.** 2-mfd. condenser, type 50 ..		3	6
1	**Dubilier** 2-mfd. fixed condenser, type BB		3	6
1	**Ferranti** new type 5,000-ohm resistance		1	0
1	**Benjamin** "Autocontrola" unit ..		7	6
1	**Westinghouse** Westector W.6.. ..		7	6
1	**Dubilier** 100,000-ohm 1-watt resistance		1	0
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LOUDSPEAKER.

WE have already dealt with the balanced-armature principle under a separate heading, but we have still to consider in detail the other popular principle—i.e. the moving coil.

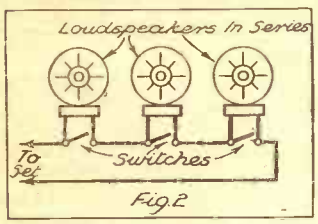
The moving-coil principle was invented by Sir Oliver Lodge in 1898, but did not come into general use until some thirty years later.

Its theory of operation is quite simple. Attached to the diaphragm is a small coil, and this coil is situated between the poles of a strong magnet.

When current is fed into the coil (it is often referred to as the speech coil) it (the coil) tends to move at right angles to the lines of force set up by the magnet. In this way the diaphragm is vibrated in accordance with the current variations.

The early moving-coil loudspeakers invariably employed electro-magnets, but recently improved technique has enabled the desired intense magnetic fields to be obtained with permanent magnets. Nevertheless, "mains-actuated" moving-coil speakers are still widely used, especially with mains sets.

TRIPLE OUTPUT



Illustrating the method of joining three or more speakers in series with simple switches to take any speaker out of circuit as desired.

It will be appreciated that the efficiency of a moving-coil loudspeaker to an extent depends upon the freedom of movement of its speech coil (and diaphragm), and upon the intensity of the magnetic field in which it moves.

A wide "gap"—i.e. space between coil and pole pieces—ensures that rubbing will not take place should the coil become distorted or go "off centre," but will reduce the sensitivity. It is largely a mechanical problem to obtain a satisfactory compromise.

The impedance of the speech coil is very low, sometimes a matter of only a few ohms, and, advantageously, it varies little at different audio-frequencies.

Clearly, though, a transformer of the step-down type is necessary to "match" the coil with the output stage of a set. Such a transformer is frequently included in the construction of the loudspeaker.

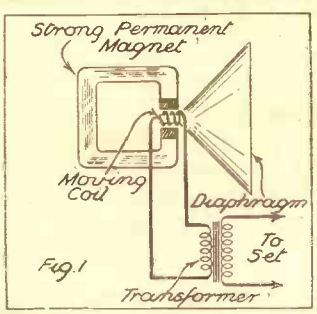
In order that the low notes should be reproduced properly a "baffle" is required, as has already been shown. If notes of 32 cycles are desired the baffle must have an overall area of at least 110 inches square (32 inches square is needed for 100 cycles).

Alternatively, a well-designed cabinet can be employed, and is generally preferred owing to its greater compactness. In this case care must be exercised to prevent resonances within the cabinet, either by padding it with absorbing felt or other substance or by opening its back, although this latter may not always result in a complete elimination of the effect.

There are other loudspeaker principles which have not been discussed in this survey, and these are the "reed," wherein vibrations are imparted to a diaphragm merely by the fluctuations from a magnetic system directly affecting a metal "reed"; the "inductor" principle, also an electro-magnetic method, and the capacity or condenser type.

In this last advantage is taken of the fact that the plates of a condenser are attracted to each other when they are given an electrical charge. In the condenser type of loudspeaker the diaphragm comprises a thin, flexible sheet of metal in close proximity to a fixed, solid plate, the two plates thus constituting a condenser.

SPEAKER MATCHING



This diagram of the essentials of a moving-coil loudspeaker shows how a step-down transformer is used to match the coil with the output of the set.

General Notes.

The object of making the diaphragm of a loudspeaker in conical form is to obtain as great a stiffness as possible and still keep the diaphragm light in weight. A flat diaphragm of similar material to that usually used would not vibrate as a whole, and it can be visualised that initially only the centre of it would be pulled in and out, the vibrations extending to the edges in waves.

Even with stiff material and good conical construction there is a tendency for this to happen at the higher frequencies. The technical term for the effect is "paper break-up."

The conical construction intensifies the directional effect of the higher frequencies, which leave the speaker in the form of a beam.

When it is desired to use two or more loudspeakers it is generally convenient to join them in series (Fig. 2). Simple single-pole (on-off) switches can then be used to cut out of circuit those speakers not desired. But it must be realised that proper "matching" becomes difficult in such an instance.

Should long leads be used, perhaps to connect loudspeakers in other rooms to the set, an output transformer or choke-condenser filter in the set itself is highly desirable, otherwise the leads will be carrying the H.T. current.

LOW TENSION.

The voltage applied to the filament or cathode of a valve. It is frequently abbreviated as L.T., and the L.T. battery is the battery used for the purpose of supplying filament-heating current.

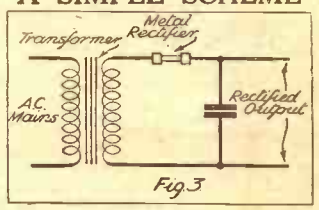
METAL RECTIFIER.

A rectifier consisting of an oxide-coated copper plate in contact with a lead plate. The rectification occurs between the copper and the layer of copper oxide on its surface, the purpose of the lead merely being that of making contact with the oxide.

In practice a number of "sandwiches" of this nature are combined in each metal rectifier "unit" when it is desired to handle more than a certain voltage or current.

A series arrangement is necessary for the higher voltages, and groups are joined in parallel for the greater currents.

A SIMPLE SCHEME



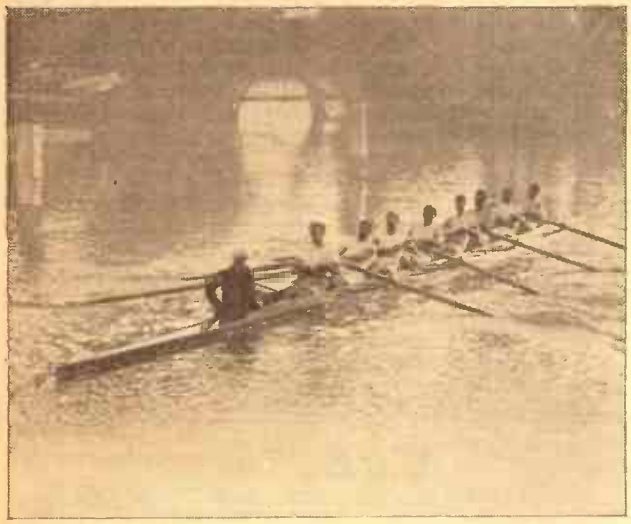
A metal rectifier can be used as an alternative to the valve rectifier in practically any circuit.

The metal rectifier was originally developed for use in mains apparatus, and in this work it can be used as an alternative to the valve rectifier in practically any circuit. In Fig. 3 it is shown connected as a half-wave rectifier.

More recently a special type of metal rectifier able to rectify (detect) at a radio frequency has been perfected. Known as the Westector, this can displace the valve as a detector in certain circumstances, and is widely used in automatic volume control circuits.

It is also employed in a H.T. economy arrangement for reducing the H.T. current taken by a power valve.

UNIFORMITY



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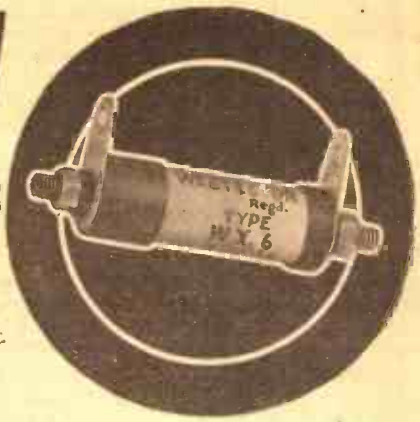

RADIO-FREQUENCY DETECTION

Since the introduction of the type "W" Westector a year ago, experimental work has been proceeding on the lines of making a metal rectifier suitable for use as a detector at radio frequencies.

This research has culminated in the production of the "WX" Westector, which uses smaller rectifying elements with a corresponding decrease in capacity, enabling it to be used in a satisfactory manner at frequencies of up to 1,500 kilocycles.

The "WX" Westector has a very high impedance, throws but little damping on the circuit and may be used as a detector in any type of receiver. It will work efficiently with an H.F. input as low as 3 volts, and good results may be obtained with even lower H.F. voltages by biasing the Westector to a point of optimum rectification.

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PRICE 7/6

MORSE PRACTICE FOR EVERYONE

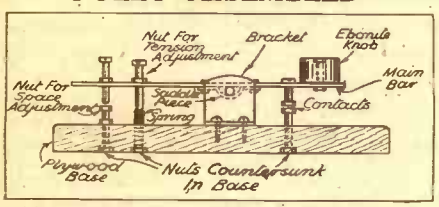
The increasing interest in short-wave listening is bringing a renewed desire to know the Morse code. Below are details of a simple practice key which can be made from odd material in the workshop.

ALTHOUGH there are many constructors who are fully acquainted with the Morse code, there must be a very great number to whom the dots and dashes have little significance. These listeners often have no means available with which to practise the code, and are therefore unable to familiarise themselves with it sufficiently to attain the required speed necessary to decipher a straightforward message—yet all that is needed is a Morse key, a battery and a buzzer.

A very efficient Morse key, however, can be made quite easily from odd workshop material. It will be seen from the accompanying diagrams that the main portion consists of a piece of aluminium, which is pivoted on two elbow-shaped pieces of similar metal. A block of plywood, a small spring and a few 6 B.A. nuts and bolts complete the material required.

The spring and stops are adjustable in order that the tension on the key and the space between the contacts can be varied according to individual requirements.

FULLY ASSEMBLED



The complete diagram of the key ready for action makes the method of construction perfectly clear.

The main bar, saddle and brackets should first of all be cut from one piece measuring $8\frac{3}{8}$ in. × $\frac{3}{4}$ in. The strip must be smoothed off by slightly rounding the sharp edges and subdivided into four parts, the length of the main bar being $4\frac{1}{8}$ in., the saddle $1\frac{1}{4}$ in. and the brackets $1\frac{1}{2}$ in. each. This completes the actual cutting, and once the smaller pieces have been shaped as illustrated the necessary holes can be drilled.

Easily Constructed.

To ensure satisfactory drilling a light line should be marked down the middle of the main bar and the hole positions scratched on the metal. Measuring from the rear end, these positions are: $\frac{1}{2}$ in., $\frac{1}{2}$ in., 1 in., $\frac{3}{4}$ in., $\frac{1}{2}$ in., $\frac{1}{2}$ in.

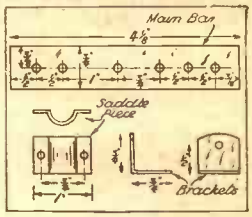
The saddle piece must fit flush against the underside of the main bar, with the holes $\frac{1}{4}$ in. apart. A size 32 drill should be used for each hole.

The gap adjustment is made possible by enlarging the end hole and inserting a 6 B.A. nut. Two small brass washers are soldered to either side of this nut to keep it firmly in position.

With the above parts on hand the key is now ready for assembling. The brackets are screwed to the plywood base at a distance of a little over $\frac{3}{4}$ in. apart. This allows for the inclusion of two small washers to prevent side play.

The bolt which acts as a pivot is passed through the brackets and saddle piece and held in position by means of a nut. By fixing a battery and buzzer in circuit practice can be commenced.

THE PARTS



Showing how the main bar, the saddle piece and the brackets are cut and drilled before assembling.

It is a mistaken opinion among many keen listeners that commercial transmitters work at a speed greatly in excess of amateur capabilities. This, of course, is far from practice, and it can be safely assumed that very many do not average more than 20 words per minute counting five letters to the word.

In fact, on the ultra-short wavebands it is not uncommon to receive stations transmitting at no more than 12 words per minute, and sometimes even less. At these speeds reception should not present any difficulty after a little regular practice.

A. W. Y.

SPECIAL BEGINNERS' SUPPLEMENT—CONTINUED.

RADIO SUMS SIMPLIFIED

IN last week's talk on simplified radio sums we discovered that a logarithm is made up of two parts. The first is the *characteristic* and the second the *mantissa*. To find the mantissa we have to look up the number in a set of tables, but the characteristic we supply ourselves.

Many of you will already have a suitable set of log. tables in your possession (such as those in the "Manual of Modern Radio"), especially if you have some old school books handy. "Logarithmic and other Tables," by Frank Castle, M.I.Mech.E., is a particularly useful little book. It includes logs., anti-logs. and a mass of other time-saving information. The cost is sixpence, and the publishers are Macmillan & Co., Ltd., St. Martin's Street, London.

Well, assuming that you have the necessary four-figure tables, the next procedure is to discover how to use them. This is not difficult, as you will quickly see.

Here goes. On this page we are reproducing a small extract from a set of four-figure log. tables, and this is how you would find the log. of a number:

Suppose you wanted to know the log. of 5163. First of all, run your eye down the extreme left-hand column for the first two figures of the number. In this case they happen to be 51. Right! Now cast your eye along the rows of figures opposite 51 until you arrive at the number 7126 under the figure 6 in the top row. This is the mantissa of the number 516; but the number we are finding the log. of is 5163.

This is not difficult. All that you have to do now is to proceed along the top row of numerals, and past the first figure 9, until you come to the numbers that are split into three groups of 1 2 3, 4 5 6 and 7 8 9 respectively.

These three columns are the differences. The fourth figure of the number 5163 is found under the figure three in the first difference column and in the 51 row. By a coincidence it happens to be 3. Add this to the log. of 516 and you get 7126 plus 3, which is equal to 7129.

Thus you have the mantissa of the number 5163. The characteristic of 5163 is three, i.e. one less than the number of whole numbers. You can also prove this by first principles if you bear in mind that the log. of 1,000 is three and of 10,000 four (1,000 = 10^3 and 10,000 = 10^4; see last week's article).

Hence log. 5163 is 3·7129.

Suppose we run over this quickly once more.

To find the log. of 5163:

For the first two numbers 51 look down the extreme left-hand column, and then along the row opposite 51 until you arrive at the third number, 6, in the *top* left-hand row. The four figures in the 51 row and 6 column are 7126. To find the last figure of the number 5163 look in the differences column under 3 and in the 51 row. The difference to be added is 3. Add this to 7126, making a total of 7129. Find the characteristic, which is 3 in this case. The log. of 5163 is, therefore, 3·7129.

But what if the number be 51·63 or 516·3 instead of 5163? Would the log. be very different? The answer is, "No." Only the characteristic would be changed.

Thus log. 51·63 becomes 1·7129, and log. 516·3 is 2·7129. The characteristic in each case is one less than the number of figures to the left of the decimal point (one less than two figures (51) is one, and for 516 it is two).

But often it is necessary to find the log. of numbers which are less than unity. For instance, such numbers as ·134, ·062, and ·0004 are all less than one.

Decimal one (·1) is merely another way of writing 1/10. Decimal nought one is the same as 1/100. With numbers of this kind the characteristic is negative and next week we shall have more to say about this.

WHAT A LOG. TABLE LOOKS LIKE

	0	1	2	3	4	5	6	7	8	9	1 2 3	4 5 6	7 8 9
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1 2 3	3 4 5	6 7 8
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1 2 3	3 4 5	6 7 8
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1 2 2	3 4 5	6 7 7
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1 2 2	3 4 5	6 6 7
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1 2 2	3 4 5	6 6 7
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1 2 2	3 4 5	5 6 7

This extract from a table of logarithms will help you to follow the simple examples given on this page.

ABOVE the STRATOSPHERE

We have heard a great deal lately about the attempts to fathom that unexplored region above the earth's atmosphere—the stratosphere. In this particularly fascinating article our contributor deals with still more remote regions above the earth and their proved effects upon radio transmission and reception.

By SEXTON O'CONNOR.

IF we could travel straight upwards from the earth's surface we should pass in succession through the following regions: First, the ordinary, an atmosphere of comparatively dense air subject to violent storms and other movements in bulk; next, a calmer and more-rarefied layer known as the "stratosphere," at a temperature of from 70 to 100 degrees below freezing; then the "ozonosphere," a warmer region sparsely occupied by oxygen; and finally, the "ionosphere," stretching up to a height of 150-200 miles.

"Free" Electrons.

The ozonosphere normally contains very diffused oxygen, but under the impact of ultra-violet rays from the sun the oxygen molecules are split up into free electrons and ozone. As the gas molecules are widely separated, electrons liberated from one molecule do not readily form up with another, but remain in the "free" state.

The ionosphere is the home of vast multitudes of free ions and electrons, which have been projected directly outwards through space from the sun and trapped in these outer confines of the earth.

The ozonosphere and ionosphere are both essential to long-distance wireless reception. The latter is the seat of Appleton's Layer, which reflects the shorter waves; whilst the former contains the well-known Heaviside Layer, which handles the medium and longer waves. Since both layers are formed by radiation from the sun, conditions there naturally vary from time to time. As wave reflectors they are more efficient at night, when conditions have "settled down" to a state of equilibrium.

Certain highly interesting but little-known effects can be traced to this picture formed by modern scientists of an earth surrounded by at least two highly ionised layers.

We know, for instance, that the earth is a huge magnet having a North and South Pole. There will, therefore, be a magnetic field and magnetic lines of force stretching in all directions from North Pole to South. At the same time the ionised layers in the ozonosphere and the ionosphere must be considered as conductors, since electrons can move freely through them.

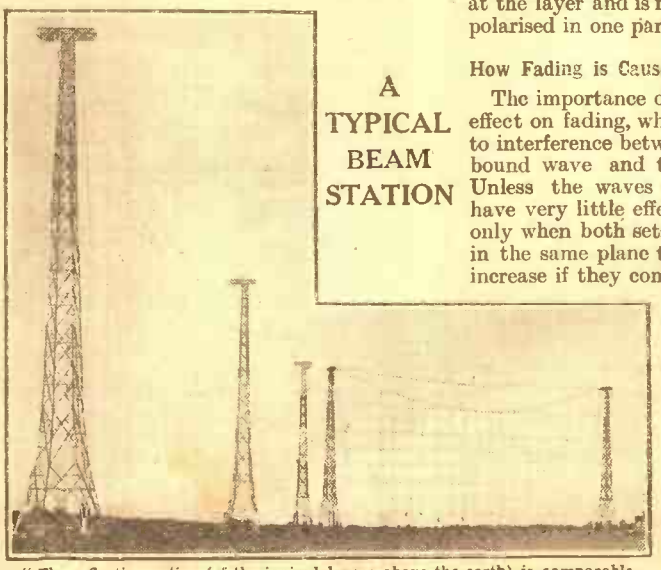
Generating Electric Currents.

Now, when a wire or other conductor is moved bodily through a magnetic field a current is induced which tends to flow through the wire in a direction at right angles both to the wire and the field. This is the well-known principle of the dynamo, where a coil of wire is driven past a series of magnetic poles to generate a constant supply of electric current.

Accordingly, if the upper ionised layers are moved bodily through the earth's magnetic field we must expect an electric current to be generated. Although both the ozonosphere and ionosphere lie well outside the turbulent movements of the ordinary atmosphere, they are, nevertheless, subject to influences which cause them to move bodily in definite directions.

Effect of the Moon and Sun.

The action of the moon, as we know, produces tidal movements in the sea. So does the sun, though the effect is less pronounced. In exactly the same way both heavenly bodies cause tidal movements, both in the atmosphere and in the more attenuated regions which lie far above.



"The reflecting action (of the ionised layers above the earth) is comparable with what occurs in "beam" wireless, where a single transmitting aerial is backed by a series of reflecting wires."

When a wireless wave comes in contact, say, with the Heaviside Layer it sets the free electrons into motion at its own frequency. The more easily it is able to do this (i.e. the more "free" electrons there are about) the less energy is wasted or absorbed and the more completely is the wave reflected back.

The reflecting action is comparable with what occurs in "beam" wireless, where a single transmitting aerial is "backed" by a series of reflecting wires. The waves from the single energised aerial set the reflecting wires into oscillation, and they re-radiate or reflect the waves back in the required direction. Very little of the total energy is absorbed or "wasted" by the reflecting wires.

Polarised Waves.

There is, however, another factor which comes into play at the Heaviside Layer. The earth's magnetic field, as we have already seen, is constantly acting on the free electrons in the layer, tending to move them along definite paths. For this reason the layer does not "conduct" equally well in all directions, but favours that in which the electrons are already in motion.

The consequence is that the reflected wave is substantially "polarised" in that plane. If, for instance, we imagine the wave as it arrives at the layer to be of the higgledy-piggledy variety (i.e. polarised in all directions), then it is definitely sorted out at the layer and is returned to earth largely polarised in one particular plane.

How Fading is Caused.

The importance of polarisation lies in its effect on fading, which, as we know, is due to interference between the direct or earth-bound wave and the reflected sky wave. Unless the waves are polarised they can have very little effect on each other. It is only when both sets of waves are polarised in the same plane that signal strength will increase if they combine together in phase and will fade if they arrive out of phase.

The ground wave is already polarised, because the earth's surface gradually absorbs the vertical magnetic component and dissipates it in the form of eddy currents.

As we have seen, the sky wave is similarly polarised by reflection from the Heaviside Layer. Accordingly the two waves are able, when they meet, either to destroy or strengthen each other in the way so typical of fading. The effect is intermittent, because the conditions at the Heaviside Layer do not remain absolutely constant, but tend to fluctuate slightly from time to time, thus "shifting" the plane of polarisation.

TESTED AND FOUND-?

Being leaves from the Technical Editor's Notebook

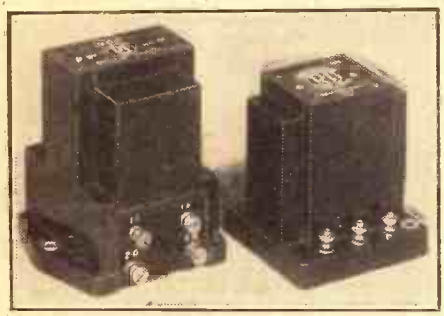
NEW COMPONENTS FOR Q.P.P.

QUIESCENT Push-Pull has always remained a fairly attractive alternative to Class B amplification, but since the introduction of the new QP21 valves it is likely to come very much to the forefront.

The QP21 is two pentode valves in one, and it enables "Q.P.P." more simply and more effectively to be put into practice.

The only snag is that the new valve has new optimum load requirements, so that many of the transformers at present fitted to loudspeakers will not be suitable for it.

However, that ever-enterprising concern, Radio Instruments Ltd., Purley Way, Croydon, are already in production with an output choke which enables the difficulty to be overcome.



The new double pentode valve for Q.P.P. (the Q.P.21) has necessitated the production of specially matched output chokes. Here is the R.I. model, together with a suitable input transformer of the same make.

Styled the DY53, this choke provides three ratios with which the new valve can effectively be matched with speakers adjusted for ordinary triode and pentode valves.

It is a very useful component.

AN INEXPENSIVE CHOKE

The two main requirements for an efficient H.F. Choke are high inductance and low self-capacity. The inductance is necessary so that the choke can offer a high impedance to H.F. currents, but this would be offset were the self-capacity to assume undue proportions.

Sectionalising the windings reduces the self-capacity, but considerable wire is needed with an air core to build up a reasonable inductance.

So, when one is faced by an H.F. choke of the very small physical dimensions of the Bulgin Junior, having a specification of 190,000 micro-henries and a self-capacity of a mere three and a half micro-microfarads, one looks for either a miracle or a departure from conventional design.

Robust and Cleanly Finished.

Actually what has been done is to employ a special core of magnetic material. Not in itself an original idea, but in this case very effective.

The choke costs only two shillings, and its performance is most satisfactory over the whole broadcasting range from about 200 to 2,000 metres.

It is built into a robust and cleanly finished bakelite casing, and its terminals are placed just right for easy and efficient wiring. Soldering tags are also fitted for those who desire to make soldered connections.

The makers are, of course, A. F. Bulgin & Co., Ltd., of Abbey Road, Barking, Essex, who, by the way, produce one of the most interesting catalogues in the radio industry. It is packed with diagrams and useful articles covering all the standard arrangements, as well as the newest developments.

It is a practical text book which all constructors should make a point of securing.

The very small dimensions of this new Bulgin H.F. choke have been made possible by the use of a special core of magnetic material. This has produced a very effective result, although the price of the choke is no more than two shillings. Soldering tags and terminals are provided.

THE "SLOT" FILTER

An old tag lays it down that names are of little importance, and suggests that if a rose were called something else its attractiveness would not suffer at all.

Of course, that is wrong; names do matter very much.

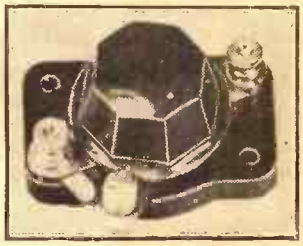
And in radio, as in many other things, a short, easy-to-remember name that is descriptive of the device in one way or another is an immense selling asset.

"Slot," the new product of Graham Farish, Ltd., Masons Hill, Bromley, Kent, is a magnificent example of apt nomenclature, and I haven't noticed that Messrs. Graham Farish have had to explain why they chose it!

In fact, it is so self-descriptive that I am quite sure that if the device were advertised in such a way as just "Fit a Slot to your Set" even the non-technical listener would know what it was supposed to do.

"Slot" perfectly describes a selectivity action, and in doing only that the article is a notable contribution to radio. If the listener can be made to think of the ether as being divided up into layers of wavelengths, and an instrument capable of admitting just the one layer and excluding all others as a "Slot," he will go a long way towards getting to grips with the fundamentals of the art and the necessity for all these plans and remarshallings of the ether.

The "Slot Aerial Filter" definitely does contribute



This is a picture of a "Slot," the self-descriptive name applied to the new Graham Farish aerial filter, which is very effective in operation.

keen selectivity to a set, and thereby acts up to the promise of its name.

It must not be confused with that type of selectivity device which gains its ends by virtually eliminating the aerial and reducing the power of the set to a low level. If perfect selectivity is the elimination of all sensitivity except just enough to pick up a few powerful stations, then these articles are perfect!

But, of course, selectivity without sensitivity is of little use.

An Attractive Proposition.

"Slot" is based on the sound and satisfactory series-capacity principle. Nevertheless, it is more than a condenser. In the one extremely compact little construction there is both a condenser and a switch for switching the device out of action when not required.

Yet, all ready to fix to a set, it costs only 2s., which would be a reasonable enough price for a small variable condenser alone and makes it an attractive proposition for all constructors as well as for listeners in general.

The adjustment is made by rotating the knob, and a very low minimum capacity is given, together with a wide range of control. The action is particularly smooth, and settings remain "put" even against mechanical vibration. This, as will be agreed, is a most desirable feature.

Is there any better way of improving the selectivity of a set without seriously upsetting its "innards" than by fitting a "Slot"? Well, I cannot say more in favour of the device than that if there is a better, simpler and cheaper way I haven't heard of it.

Shortening the aerial? What about the long waves? With a "Slot" you are "as you were" by the flick of a switch, and that is a final argument in its support!

Jottings of Interest to Buyers.

By G. T. KELSEY.

AS a result of my tests with the ingenious "Bifocal Three" receiver I was confident from the start that the set was destined to be a winner. But that it should have been such a phenomenal success as it has turned out to be and in so short a space of time is a surprise even to me.

Everywhere I go I hear nothing but focused radio. It seems to be the one topic of conversation at the moment, which all seems to point to the fact that the interest in distant listening is far from being on the wane. The reception which has been afforded to this set, both by the trade and the public alike, is most stimulating, and from what I can see of it the set will be as popular six months hence as it is to-day.

In the interests of "P.W." readers I have made careful inquiries into the question of the supplies of the parts from which the set is constructed, and I am glad to be able to pass on the news that for the time being there is no prospect of delay. But I am told that in some cases it means working at full pressure to keep pace with the demand, and that if the demand is substantially increased in the next few days there may be some slight delays.

If you take my tip you will be wise and secure your parts now while the going is good, for I am taking it for granted that you will already have decided that this must be *your* set of the future. Frankly, with the chaos which exists in the ether at the present, if you want decent radio there is no option in the matter.

Disturbance Suppression.

Man-made static is getting worse. Every month sees an increase in the popularity of flashing signs, vacuum cleaners, hair-driers and so forth, and it certainly looks as though some sort of legislation will have to be introduced ere long to prohibit the installation of any electrical apparatus unless proper precautions are taken to ensure that it does not interfere with radio reception.

But legislation means delay, and meanwhile, thanks to Belling & Lee, there is another way out. A book that they have just published on the question of disturbance suppression is one of the best efforts that I have yet seen, and I congratulate them.

The book has been prepared by the Research Department of Belling & Lee, under the direction of E. M. Lee, Esq., and it deals with the suppression of practically all forms of man-made static. The diagrams and explanations are excellent, and I feel that this book should go a long way towards clearing up a lot of the troubles which exist.

Copies of the book, which is entitled "Disturbance Suppression," are available to "P.W." readers, price 3d. each. Direct your application to Belling & Lee, Ltd., Cambridge Arterial Road, Enfield, Middlesex, and please do not omit to mention POPULAR WIRELESS.

A New Drydex Battery.

Owners of the popular Philips 834B Receiver will be interested to learn that a special "Drydex" battery has been introduced for this set.

The type number of this new battery is H.1088, and the list price is sixteen shillings.

(*Continued on page* 1128.)

Give your set a tonic

Fit "Radio Record"—the quality valve. You will be amazed at the difference in your reception.

If you are troubled with whistling, crackling, howling, etc., the "Radio Record" D.L.2. (battery-operated) really non-microphonic Detector Valve will eliminate these interferences.

COMPLETE RANGE OF 2-VOLT AND A.C. MAINS VALVES

BATTERY HEATED VALVES

- **D.L.2.** Special non-microphonic Detector.
- **H.2.** High Frequency Amplifier.
- **L.2.** Low Frequency Amplifier.
- **L.P.2.** Low Consump. small power (also for Q.P.P.)
- **P.2.** Power (suitable in 2nd L.F. stage).
- **S.P.2.** Super Power.
- **P.T.2.** Poly electrode output.
- **S.2.** Screen-Grid H.F. Amplifier and Det.

INDIRECTLY HEATED A.C. VALVES.

- **AC/HL.** A.C. Detector and Triode Amplifier.
- **AC/S.** A.C. Screen-Grid H.F.
- **AC/VS.** A.C. Variable-Mu.
- **AC/PT.** A.C. Polytrode.
- **AC/P.** A.C. Power.

RECTIFYING VALVE

- **FW350.** Full Wave Rectifier (output 350 volts 150 milliamperes).

Prices from **3/9**

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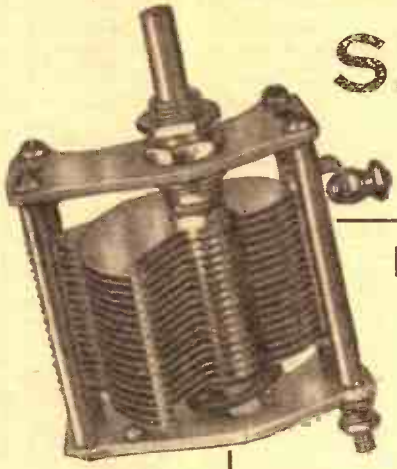
SPECIFIED for the S.T.300 STAR



POLAR No. 4

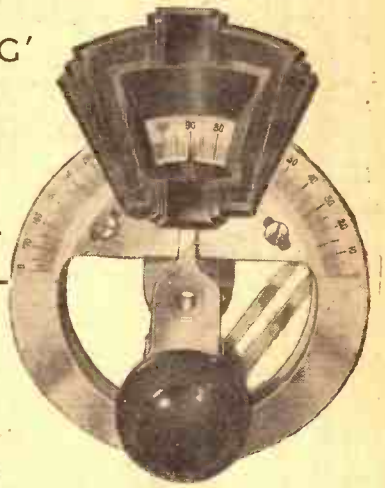
A precision condenser similar to the famous No. 2 S.M. Aluminium with brass pillars. Ball bearing spindle.

Two Required .0005 PRICE EACH **4/-**

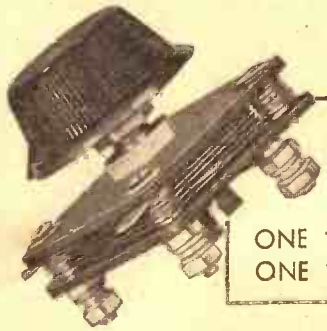
POLAR 'PANEL-MOUNTING' DISC DRIVE

Slow motion with bevelled scale. Provided with lamp holder and moulded escutcheon.

TWO REQUIRED Price each - - **5/-**



ALSO REQUIRED



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The condenser with an insulated spindle. Constructed with the highest quality materials. Smooth action. Complete with knob.

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ONE .0001 PRICE EACH **3/-**

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RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS.

PROVIDING GRID BIAS BY ARRANGING RESISTANCES IN THE ANODE CIRCUITS.

A. A. C. (Dysart).—"Having seen the arrangement of resistances used by P. P. Eckersley in 'The National Three' to provide grid bias, I would like to use the same arrangement in a straight three used for all-wave reception.

"The detector is resistance-coupled, and decoupling is used in all H.T. leads. What value of resistances are required to supply the grid bias to (1) L.F., Mullard; (2) Power, Mullard; (3) Super Power?"

It will be necessary to know the amount of anode current flowing in each lead, and this depends to some extent on H.T. voltage, which you do not give.

In theory this calculation of the necessary resistances is extremely simple, and it is quite possible to ferret out all the information from Ohm's Law, in a simple manner, for any given combination of valves, H.T., etc. But in practice there are a great many little points to watch if the scheme is to be successful.

You will find that a practical article on the subject appeared in the January 28th, 1933, issue of "P.W." (number 556), and we advise you to turn up this and read it carefully, applying the hints given there to your own case.

(If you have not the back number in question and cannot obtain it locally, it can be supplied by the publishers. The address is The Amalgamated Press, Ltd., Back Number Dept., Bear Alley, Farringdon Street, London, E.C.4. The cost of "P.W." back numbers supplied direct in this way is 4d. per copy, including postage.

SHOULD PICK-UP INPUT WIRING ALWAYS BE SCREENED?

D. L. (Stretford, Manchester).—"I understand exactly what to do as regards the connections for the pick-up and switch, and also volume control, which have been fully explained in 'P.W.' But there is one thing about the actual wiring which I do not understand.

"Sometimes the pick-up lead is shown as a screened lead. (In the 'Eckersley Radiogram' I notice that this kind of lead is used to make connection, as well as for screening, but in most of the sets I have noticed there is an earthed outer casing.)

"Why is this used in some sets and not in others? And do you think that a screen on the lead is advisable in my case, with S.G., det. and 2 L.F. circuit, arranged as shown in enclosed sketch?"

Pick-up leads, which are often necessarily rather long, are particularly liable to unwanted interaction, hum, etc., and the idea of the screened pick-up lead is to prevent this trouble.

Sets which are adapted for pick-up working are naturally more likely to have trouble of this kind than those in which the gramophone connections are an integral part of the design. And modern high-magnification sets are much more liable to it than the older and simpler sets.

A good general rule is that, unless the wiring is really very short indeed, it is better to use screening. And as yours is a case in which very short wiring is not practicable we recommend you not to trust to unscreened leads.

THAT AUTOMATIC CONTROL OF VOLUME.

Many readers have been indignant because "Disgruntled," of Pershore, recently questioned the merits of automatic volume control.

One stalwart, signing himself "A. B. J. (Wallasey)," after sarcastically dressing down "Disgruntled," concludes his letter with the remark: "I pray and hope for the day that some volcanic eruption will submerge Pershore beneath the sea!"

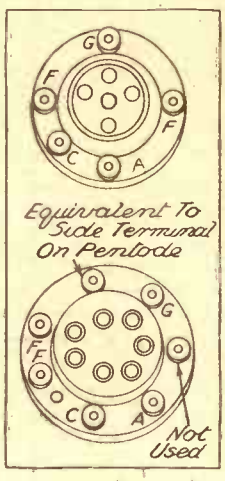
A Buckinghamshire reader, in a P.S., also tilts at "Disgruntled." "On my Varley Superhet," he says, "the A.V.C. is so effective that I should like to give a V.C. to the man who invented it; and somebody ought to take your correspondent ('Disgruntled') and put him where the Big Bad Wolf will find him."

The general consensus of opinion is that A.V.C. is one of the greatest blessings conferred on receiver design. And several correspondents ask why it is not incorporated as standard on all "P.W." designs.

The reason is that to be effective automatic volume control requires a greater-than-ordinary level of input, so it is not commonly installed on sets with less than two H.F. stages.

Moreover, the extra components required do not come within the reach of all pockets, but readers can rest assured that the "P.W." Research Department is watching automatic volume control very closely.

VALVE HOLDER CONNECTIONS



The two diagrams to the left indicate how a seven-pin A.C. output pentode can be used in place of a five-pin valve of the same type.

* * *

In the upper diagram are shown the five-pin connections. (The actual valve holder may be marked P. instead of A.)

* * *

The lower diagram shows the seven-pin valve holder as used for an A.C. pentode, with equivalent lettering.

THE VAGARIES OF RADIO NORMANDIE.

Another question which has been well to the fore in readers' correspondence is the strength of the programmes from Radio Normandie.

There has been a remarkable divergence of opinion about this station, and although the majority of listeners find themselves in exactly the same position as our original correspondent—who complained that since the operation of the Lucerne Plan he had lost the programmes—others are still getting good results.

(A curious point is that comparatively distant aerials are generally those which get the satisfactory results now, and those districts which were previously well served are the source of the strongest complaints.)

In general, our correspondence on this subject amply backs up our original contention that we cannot now expect such clear reception as was experienced before the changes took place.

HOW MANY MILLIAMPS?

E. C. R. (Barkingside, Essex).—"Is a current of ·05 amps. the same as one of 50 milliamps?

"I didn't start early enough on your Beginners' Supplement to get this information, so I should be glad if you can make it clear."

Yes. The prefix "milli-" means 1/1,000th., so a milliamp is 1/1,000th of an ampere.

Expressed as a decimal fraction this is ·001. And consequently 50 milliamps can be expressed as ·05 amp. (Actually, ·050, but with the last nought omitted, as is usual with demicals.)

OVERCOMING A DIFFICULTY WITH NO-GAP COILS.

"No-gap" constructors will feel indebted to Mr. J. Wallace Anderson, of 62, Jeenet Street, Liverpool, 7, for some particulars he gives in a letter to the Editor, evoked by the recently published remarks of Mr. R. Mervyn Lee. (In "P.W.," dated February 10th, 1934, page 998.)

Telling of how he overcame the difficulty of knowing on what waveband the set was tuning, he says: "I drilled three small holes on the panel, opposite each coil and then a similar hole on the knob.

"I filled this with white lead, and when the dot on the knob is opposite the various 'dots' on the panel you have the different ranges of the coils.

"Starting from the left hand, you have the low waves, the centre the medium, and the right the long waves. I also did the same with the on-off switch, and put transfers 'On,' 'Off.'

"I may say, in conclusion, that I am highly delighted with the set."

Other readers who proffered suggestions are also thanked, and we think they will agree that Mr. Anderson's way of getting round the difficulty is an eminently ingenious and satisfactory one.

AN EASILY FITTED LOCAL-DISTANCE SWITCH.

F. J. N. (Walsall)—"In your description it says: 'A very good auxiliary control can be obtained by arranging a resistance of about 50 ohms, so that it can be connected between the aerial and earth by means of a switch,' etc.

"I should like to try this, but, knowing nothing about it and the kind of switch not being specified, I am not sure if the following is right. (I don't want any more expensive flashes!)

"Is this O.K.? Ordinary on-off switch connected with one side to earth terminal, and other terminal of switch to one end of resistance. The remaining terminal on the

(*Continued on page* 1128.)

H.F. CHOKES & SWITCHES

ARE YOU BUILDING THE WONDERFUL NEW "BIFOCAL 3"?

This new receiver of revolutionary design marks a very great step forward. Its performance is far in advance of any set yet published. Only the finest components are used, and results are guaranteed.

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Technical Details:

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Fully screened in frosted aluminium-finished universal-mounting cases, fitted with locked terminals. Self-inductance, 250,000μH.; Self Capacity, 2·5μμF. approx. D.C. Resistance=400Ω. Smooth peakless choking, 98% approx. for 200-1,800m. (Range actually greater to good percentage.)
LIST No. H.F.9, 3/6 EACH.

WAVE-CHANGE SWITCHES.
Fully insulated, snap toggle-action double-pole two-way switches. Complete with LONG/MEDIUM indicating plate. Nickel-plated parts and laminated insulation. Contact resistance, under 0·01Ω. Insulation resistance, over 50MΩ. Terminal connections.
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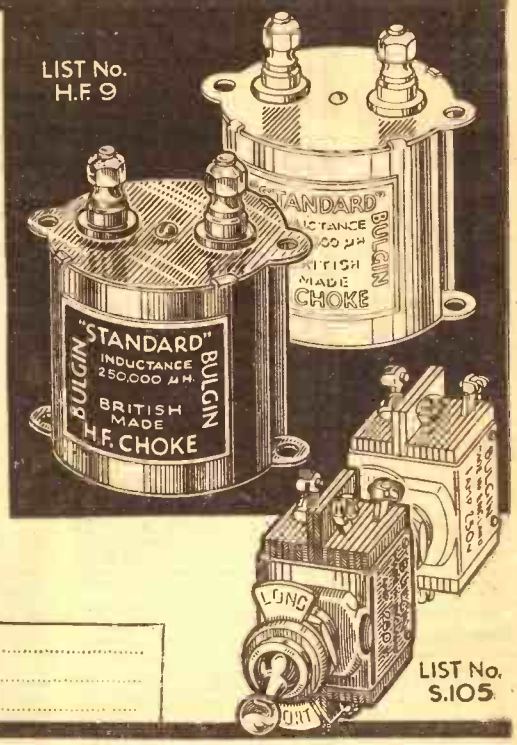

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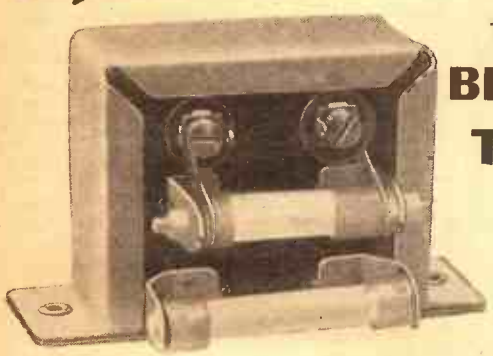

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RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 1126.)

resistance to the aerial terminal; all other wires as before."

Yes, this is the correct wiring for the scheme in question.

TESTING COMPONENTS WITH A LOUD-SPEAKER AND DRY CELL.

C. T. A. (Windsor).—"About this time last year you were kind enough to send me some details for testing out components with dry cell and loudspeaker. And very handy I have found that information, which enabled me to find not only the fault on my own set, but to help out friends who were having trouble with their wireless.

"Since then, having acquired a name for testing, I have been confronted with posers in the shape of sets having new components in them which were strangers to me—for instance, a big-capacity 'wet' condenser and Class B components.

"Can these be checked by the 'listening-for-the-click' method? If so I would greatly value any details you can give for simple testing, to enable me to enhance my reputation!"

It is not possible to test electrolytic condensers by this method, but it can be used for Class B transformers in much the same way as for the ordinary type.

First touch the two test leads on the primary terminals of the transformer, viz., those marked H.T + and A. (or P.). The usual double click should be heard if the winding is O.K.

If there are more than two terminals on the primary, as sometimes is the case, the test can be carried out between any pair of them, so check them all.

Deal with the secondary terminals in the same way, checking between the G. and G.B. terminals (the G.B. terminal is sometimes marked C.T. or C.), and also checking between one of the primary and one of the secondary terminals to make sure that there is *not* a continuity click between these two points.

When Testing Potentiometers.

Be extra careful when testing potentiometers, as it is not sufficient merely to apply the leads to the two outer resistance terminals, as is the case when testing an ordinary fixed resistance.

The usual double click should first be obtained across these points, and then the test leads should be transferred to connect across one of these outer terminals and the centre (slider) terminal.

Now turn the control knob to various settings, to make sure that contact is O.K. all round, which will be indicated by the occurrence of the clicks at all settings. (It is not always possible to spot a faulty slider-contact by inspection.)

Remember, also, that the method cannot generally be used for testing condensers unless the capacity is ·01 mfd. or greater. And for condenser testing the clicks will be different from those obtained for resistances, coils, etc.

In the case of the condenser, one lead remains connected to one of its terminals throughout the test. The other test lead should first be touched against the remaining condenser terminal, when a single click should be heard.

The bigger the condenser the larger this click should be. If there is no click the condenser is faulty.

Next, one test lead should be disconnected from the condenser, and *no* click should be heard when this is done. (If a definite click *is* heard the condenser is faulty.)

The test lead should then again be touched against the condenser terminal, and if no click results from this second contact the component may be considered as having passed the test.

Remember that very small condensers (i.e. those of low capacity) will not give the loud clicks which will result when the value is ·01 mfd. or more. And don't forget to disconnect from the set any component before testing it, or misleading results may be obtained owing to the other wiring.

THE LINK BETWEEN

(*Continued from page* 1124.)

At the B.I.F.

During a recent tour of the British Industries Fair, I was particularly fascinated with the Ekco exhibit.

The striking possibilities of bakelite for radio cabinets was exemplified by the exhibition of specimen cabinets in red, green, walnut, blue, cream, ebony black, marble, amber and in mosaics of brilliant colours. Many of the novel and extremely pleasing effects which can be obtained by combining metals and bakelite were also particularly interesting.

A fine example of what can be done was the new Ekco model 64 receiver which was exhibited on their stand. I understand from a high official of E. K. Cole, Ltd., that the cabinet for that particular set was planned by Mr. Serge Chermayeff, the famous British architect, whose scheme for the new "shadowless" seafront at Bexhill-on-Sea has aroused so much comment.

Focused Radio For All.

I learn with interest as we go to press that Varleys have just published a special "Bifocal" conversion leaflet for existing sets. It gives full details and circuit diagrams of the already famous focusing coil, together with instructions as to how the coils may easily be fittted to almost any set.

Interested "P.W." readers can obtain a copy of this interesting leaflet by quoting the number to us on a postcard in the usual way. But the demand is bound to be phenomenal, and early application is strongly advised. (No. 78)

YOUR S.T. MANUAL

¶ The last Gift Token for "The Manual of Modern Radio" appears this week on page 1132.

¶ If you started collecting with token No. 3, you will now have six tokens. Complete your Gift Voucher and send it in at once with the necessary remittance.

¶ No more tokens will appear for the Manual. There is no point in delay. The sooner you send your Voucher with 6 consecutive tokens the soooner you will receive your Manual.

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This issue of POPULAR GARDENING (now on sale—2d.) is also a complete guide to topical work in the garden: every important seasonable task is dealt with clearly in the freely-illustrated articles with which it is packed. You cannot afford to be without this number if you desire a well-stocked flower or vegetable and fruit garden.

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THE MEN WHO RUN THE STATIONS

(*Continued from page* 1117.)

In Scotland it is now possible to determine the degree of success of a bold experiment undertaken there by the B.B.C. about nine months ago. For some years prior to the experiment B.B.C. affairs in Scotland were in the hands of Mr. Cleghorn Thomson, a young man of marked versatility and enterprise, who had gathered round him a brilliant staff reflecting, for the most part, the post-war attitude and aspirations of new movements in Scottish art, politics and industry.

With the resignation of Mr. Thomson last year the choice of a suitable successor was not an easy problem. And this is where the experiment came in. It was decided to offer the post to the Rev. Melville Dinwiddie, a minister of the Established Church of Scotland at St. Mahar's Cathedral, Aberdeen. Mr. Dinwiddie had a distinguished war record and had also been conspicuously successful as a padre in peace time. He provided a considerable contrast in outlook to that of his predecessor, Mr. Cleghorn Thomson. But the experiment has succeeded.

Increased Support Obtained.

Mr. Dinwiddie has managed not only to maintain the interests of youth and new movements, but also to attract fresh support from the older elements of the community.

He is particularly fortunate in having as his programme director Mr. Moray Maclaren, a young Highlander of the romantic school. The combination is proving ideal.

Over in Belfast there is George Marshall, who has behind him the experience of the successful administration of both the Glasgow and Newcastle stations. Mr. Marshall is a Lowland Scot of a definitely practical turn of mind. He had the difficult task of taking over in Northern Ireland from Mr. Gerald Beadle, whose tenure there was remarkably successful. But Mr. Marshall has managed "with full marks." He is now one of the leading public personalities of the Ulster county, and is proceeding to build up a new Region in preparation for the new high-power transmitter and the new headquarters which are being constructed for him in Belfast.

THE MIRROR OF THE B.B.C.

(*Continued from page* 1106.)

West Regional Items.

Nine former members of the County Borough of Swansea Police Band have attained the distinction of rising to the rank of Chief Constable, so that who knows to what dizzy heights of fame some of the present members may rise in the days to come?

The band is to give a concert for West Regional listeners in the early evening of Thursday, March 15th, when the soloist will be Tudor Davies.

The outside resources of the West Region will be "tapped" still further on Saturday, March 17th, with concert relays from the Pavilion, Bath, and Dartington Hall, Totnes.

The Bath relay will include items by Charles Hayes (entertainer), in addition to music by the Pump Room Orchestra.

A Talk on Tramping.

There can be few men who have such strong beliefs in the value of fresh air as Mr. Tom S. Hall, who is to give a talk on "Tramping" in the Scottish Regional programme on Tuesday, March 13th.

It was mainly due to his efforts that the "Glasgow Association" increased its membership from twenty to two hundred and fifty members, and that it has now its own camping grounds, holiday huts and a residence in Lamlash.

If these things were all they would be enough, but it is also due to Mr. Hall's enthusiasm that the "Rucksack Club," the "Federation of Ramblers," and the "Association of Rural Scotland" have flourished, and that people are now assisted by indicators in finding their way about Ben Lomond and Goatfell.

THE LISTENER'S NOTEBOOK

(*Continued from page* 1106.)

Mr. Douglas showed no signs of mike fright, although he said he was suffering from it. On the contrary, he seemed to make the most of his opportunity of expressing his views to those thousands of people who never read him. Yes, Mr. Douglas was, to my mind, the outstanding item of last week. Apparently he used a manuscript which he had previously submitted for scrutiny. If this is so, then it is gratifying to see that greater liberty is being given to speakers nowadays. This is a good sign.

* * *

One notices a similar freedom in some of the utterances of Mr. Pewter and family. The hunger marchers' demonstration, for instance, was discussed by this famous family in a very natural and realistic manner.

* * *

The death of the King of the Belgians provided an unexpected outside broadcast, which those of us who could eagerly availed ourselves of. The Requiem Mass was deeply impressive. The chanting,

(*Continued on next page.*)

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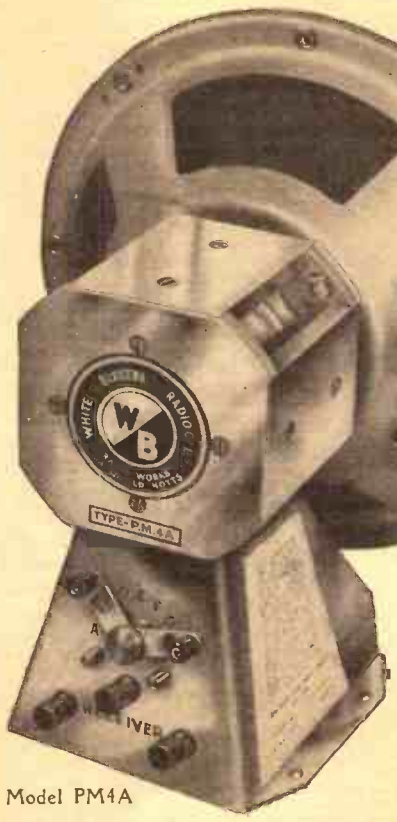

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Great Portland Street, London, W.1.
'Phone: Museum 1414.

THE LISTENER'S NOTEBOOK

(*Continued from previous page.*)

the telling silences, the trumpet call, the muffled tread of feet and the sound of hoofs all came through perfectly to produce a sound-picture which for long must remain unsurpassed.

It is such broadcasts as this that make one appreciate the wonders of broadcasting more than ever. A fragment of the relay was reproduced from a strip in the evening news bulletins of the same day. Many listeners must have appreciated this.

* * *

Have you noticed the quantities of old music-hall songs, besides others of the half-forgotten long ago, that fill the air nowadays? Have you also noticed the reception always given at St. George's Hall to old-time music-hall stars? It is significant, too, that modern melody merchants are not, comparatively speaking, creating the furore they did.

* * *

One of the most welcome bits of news lately is that Florence Desmond, the impersonator, is back home again from America, and that she is to broadcast shortly. I hope she will cut right out that American accent she seems to have cultivated. According to her own story, she has been mixing with celebrities out there, so her repertoire will have become even bigger and better. She is a treat in store.

* * *

I like impersonators. That's why I enjoyed Beryl Orde. Strange there aren't more impersonators to entertain us? This particular brand of artiste is indeed rare.

* * *

Charles Higgins is a comedian of class. He seems to be more original than most of his fellows, or has he revived a style that was once popular with comedians? The style seems vaguely familiar. Anyhow, it's good!

C.B.

LISTEN TO THESE NEXT WEEK !

Sunday — *March* 11

National. (DRAMA): "As You Like It." The next in the series of Shakespeare broadcasts. One can have too much of a good thing, but Shakespeare lovers will listen.

Monday — *March* 12

National. (MUSICAL COMEDY): "Big Business." A new musical show written by John Watt and Henrik Ege. Should be worth attention: John Watt's shows generally are. (To be repeated on the Regional wave on Tuesday.)

Tuesday — *March* 13

Midland Region. (FEATURE): "Choir and Cloister." Hereford is visited by the microphone in the third of the series of historic Midland cathedrals.
Scottish Region. (DRAMA): "A Fool and his Money." A wayside comedy by Laurence Housman, who has recently had a very good showing in Scotland.

Wednesday — *March* 14

Regional. (VARIETY): A Vaudeville programme, including Leonard Henry, Clapham and Dwyer, Ivy Tresmand, Yvette Darnac, Ronald Gourley and Billy Reid. An unusually strong mid-week "bill."

Thursday — *March* 15

National. (BAND): Military Band Concert. B. Walton O'Donnell with the world's best military band.
Midland Region. (MUSICAL DRAMA): "Our Gramophone Shop." A new show by Laurie Devine (of television fame) and her brother, T. W. Rees. Martyn Webster produces.
West Region. (DRAMA): "Queer People." Truth which is stranger than fiction told in play form by John Wyndham.
North Region. (OPERA): "Carmen." A concert version of the famous opera, relayed from Warrington.

Friday — *March* 16

Midland. (VARIETY): "The Regional Revellers." Always a popular item.
Scottish Region. (FEATURE): "Once in the Ballrooms of Europe." A programme of dances from the Pavane to the Waltz.

Saturday — *March* 17

National. (FEATURE): Running commentary on the Oxford–Cambridge Boat Race.
(VARIETY): "Tea Mixture." Matinée for variety lovers, including several first appearances.

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

The Importance of the Earth.

I HAVE more than once remarked on the fact that people will take endless trouble with their sets, and with the efficiency of the various parts of the same, and will even go to the length of an elaborate outdoor aerial, but will pay little attention to the *earth*, apparently regarding this as a mere detail, and a more or less optional one at that.

It cannot be too strongly emphasised, however, that the aerial and earth are parts of one and the same thing. The incoming oscillations which form the signal energy flow between the aerial and the earth, and although it is true that wireless waves will produce electrical oscillations in any conducting object which they strike, irrespective of whether it is connected to earth or not, these oscillations are very greatly enhanced if a proper earth connection is provided.

Not only does this, as a rule, greatly increase the actual strength of aerial signals, but a good earth connection is the best of all possible means for *stabilising* the working of the set.

It May Cause Instability.

With a poor earth, or with no earth at all, we are very apt to get poor volume, instability and even poor quality, whilst the operation of the reaction and tuning controls will be affected. If you have never realised all this just try disconnecting the earth from the set and see what sort of results you get then.

For one thing, you will probably find your tuning all shifted out of position, reaction all wrong and a few more things, which I think will very quickly convince you of the importance of some sort of earth connection, and for preference a good one.

More and more people seem to be adopting the buried plate or buried tube type of aerial. I suppose this is because connections to cold waterpipes, although they usually form excellent earths, are often inconvenient to arrange. A wire running under a window and out to the garden beneath frequently gives a much shorter and more direct earth lead.

Ensuring Good Connection.

These earth rods form quite effective earth connections provided they themselves make good contact with the surrounding ground. In the winter this pretty well looks after itself, owing to the moist condition of the soil; but in the summertime the soil may get so dry that there is a very poor connection between the earth rod or plate itself and the soil. Almost any kind of salt—even common household salt, made into a solution and poured around the plate—will greatly improve matters, and another dodge is to form a hollow in the soil around or above the earth rod or plate so as to collect as much moisture as possible. If there is a pool handy it is a good plan to bury your earth in this.

(*Continued on next page.*)

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PLEASE be sure to mention "Popular Wireless" when communicating with Advertisers. Thanks!

TECHNICAL NOTES

(*Continued from previous page.*)

Batterium.

Several readers have asked me about the metal called Batterium which I mentioned in these Notes some time back. As its name implies, it is particularly applicable to battery use, and this is due to its property of resisting the effects of various acids.

I have taken the trouble to find out something about this metal, and I understand that it is a copper-aluminium alloy containing about ten per cent of aluminium and ninety per cent copper. It is hard and tough and has excellent resistance to organic acids, and even to dilute sulphuric acid in the cold.

Comparative Resistances.

Some notes on the comparative resistance of certain metals, including Batterium, were published in the Journal of the Society of Chemical Industry for June, 1931, these representing the results of investigations made by the Applied Chemistry Department of the Royal Technical College, Salford, Lancs. The Batterium alloy is made by the Tungstone Diecasting Company, Market Harboro', who will supply any further information which any of my readers may wish.

The Question of Side-bands.

I have a letter from the president of one of the radio societies discussing the question of side-bands. As you probably remember, P. P. Eckersley gave some interesting observations on this subject in a recent issue of "P.W.," and the particular question which my correspondent raises is whether there is any known case in which two waves combine to produce another of greater frequency than either. It is, of course, perfectly well known that when two waves of different frequency combine a *beat* is produced, the beat frequency being equal to the difference of the frequencies of the two waves.

Divided into Two Camps.

My correspondent goes on to say: "It would seem to follow, if greater frequency can be so produced, that two infra-red rays could produce visible radiation, two colours an X-ray and two musical notes not only the beats but another higher note. This question of side-bands is much argued among enthusiasts, and there is much confusion."

As you know, the whole question of side-bands has always been a very controversial one, and radio experts may be said to be divided into two opposite camps: some of them have the firmest possible belief in side-bands, and regard them not merely as a mathematical abstraction but as a physical reality, whilst, on the other hand, some people strenuously deny their existence altogether.

Combination Tones in Sound.

As regards the combination of two frequencies to produce another of higher frequency, this is quite another matter, and it would take a good deal more space than I have here to go into it thoroughly. In this connection I should, however, mention what are known as difference-combination tones and summation-combination tones, which are met with in acoustics.

(*Continued on next page.*)

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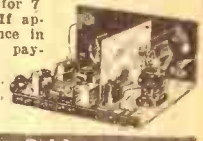

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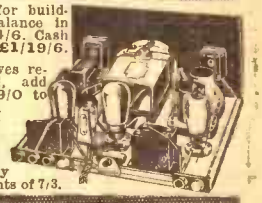

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TECHNICAL NOTES

(Continued from previous page.)

For instance, suppose we have middle "C" on the pianoforte, 256 vibrations per second, and upper "C," 512 vibrations per second, sounding together, then the first difference tone is 256 merging with one of the primaries, whilst the first summation tone is 768, the third harmonic of the lower, and all the other combination tones will fall into the harmonic series.

This question of summation tones is a complicated one, and those of you who are interested in it should consult S. Taylor's "Sound and Music," Helmholtz's "Sensations of Tone" or Barton's "Textbook of Sound."

Line-Ballast Resistances.

The American midget sets which recently made their arrival in this country make use of a line-ballast resistance for the purpose of reducing the voltage from 200–250 down to the 110 volts required to work the set.

Hitherto these ballast resistances have been fitted with a standard two-pin American plug, but now they can be obtained on the English market for replacement purposes fitted with a five-amp. type of British two-pin plug, so that they can be plugged directly into any ordinary wall plug without the use of adaptors.

Voltage Fluctuations.

Apart from the breaking down of the mains voltage to the relatively low voltage required for working the set, these also have a "ballast" effect which tends to keep the voltage fairly constant at 110 volts, even when there are slight fluctuations in the voltage of the mains.

Any resistance will do this, since the voltage variations (assuming the resistance to be non-inductive) will be the same proportion of the reduced voltages as they are of the original voltage, and in the case of the reduced voltage the *actual* value of the fluctuations will be correspondingly smaller. But these particular line-ballast resistances are adapted to give a certain amount of smoothing or reservoir effect which gives them an advantage over a simple resistance. They are supplied by Claude Lyons, the Clarostat people.

Eliminating Interference.

I am always getting letters from readers about the interference from electric lights, lift motors and so on, and also the clicking which takes place, especially in a mains set, when an electric light in any part of the house is switched on or off. I have discussed this question in these Notes before, and there have been in the past year or so several devices put on the market for cutting out this effect.

Some of these gadgets are more successful than others, although it is really a very tricky matter to make a device which will absolutely cut out all interference. A great deal depends on the circumstances of each case, and the same device will work much better with some sets than with others.

Impedance-Matching Transformers.

I have before me particulars of another dodge which uses an aerial-impedance-matching transformer at the aerial end of the aerial lead-in, and what is described as a receiver-impedance-matching transformer at the other end of the aerial lead-in. There are special connections to this latter transformer which I have not the space to describe, and, of course, there is a connection for earth. The down-lead from the aerial, by the way, is formed of metal-sheathed cable.

Great claims are made for the efficacy of this device in cutting out static and interference of all sorts, but I have not yet had an opportunity of trying it for myself. I can, however, give you further particulars of it if you want them.

Screen-Grid Stability.

When you are using a set employing reaction, as most small sets do, and the set goes into oscillation when the reaction is increased, it may be that the trouble is not in the reaction circuit itself, but in some other part; for example, the trouble may be due to the screen-grid circuit not being stable, so that this circuit oscillates when the reaction is increased. This, again, may be attributable to bad wiring or insufficient shielding of the H.F. parts, or even to the use of incorrect voltage values.

NEXT WEEK

MORE ABOUT THE

"BIFOCAL THREE"

ALSO

HOW TO MAKE A HANDY VALVE TESTER

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One point with regard to the wiring is, of course, to make the grid wiring as short as possible, whilst in some cases it may be necessary to shield this.

As regards the question of the voltage values, it may be that the voltage on the screen of the valve is too high, in which case you should try reducing it somewhat.

If you get this part of the circuit right—assuming it was unstable previously—you will probably find that it makes all the difference to the reaction control.

That "Cold" Valve.

From time to time during the development of radio we have heard of the cold or "filamentless" valve. Many attempts have been made to produce such a valve, and, in so far as a cold *rectifying* valve is concerned, these attempts may be said to have succeeded. Claims have been made for cold *amplifying* valves, but so far no very real progress appears to have been made in this direction.

The rectifying valves are based on the same principle as the very efficient metal rectifiers which are now in almost universal use for converting A.C. into D.C. for radio and suchlike purposes. The H.F. rectifier is much smaller and is useful in automatic volume control circuits, but does not seem to have really "caught on" yet for general purposes.

No Amplifier Yet.

No doubt this is due largely to the fact that it is definitely a rectifier and not an amplifier, whereas a valve rectifier of the 3-electrode type almost invariably functions, in actual practice, as an amplifier as well as a detector. The "cold" valve can, however, be used quite well as second detector in a superheterodyne circuit.

Your Paper by Radio.

According to news from the United States, a device has now been perfected which can be attached to an ordinary radio receiver and which will enable a fascimile of a newspaper or typewritten sheet to be automatically received. It is really an adaptation of the method which was evolved some years ago for the transmission of pictures. I don't mean television as generally understood, but the relatively slow building up of printed pictures. Experiments have been successfully carried out already, and, in fact, some months ago a section of a newspaper was transmitted to a ship 2,000 miles at sea.

The arrangement works something on the same lines as the tape-machine which you see in stockbrokers' offices, clubs and so on, but instead of tapping out the letters the whole of the sheet is reproduced.

A Facsimile Transmission.

In fact, a facsimile of a newspaper can be transmitted, pictures and all. The printed matter is treated and transmitted precisely as though it were a picture. A well-known American radio engineer, describing the arrangement, visualises "the Jones family" switching on to "Facsimile" on the dial before retiring for the night, and in the morning finding a little newspaper, in strip form, lying in the basket all ready for them. This carries up-to-the-minute news, instead of an edition printed at midnight the night before. It is stated that the attachment can be made to sell at the equivalent of six or seven pounds.

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TELEVISING SPEECH!

Popular Wireless

SPECIAL SECTION FOR SHORT-WAVE ENTHUSIASTS CONDUCTED BY W. L. S.

No. 615. Vol. XXV. March 17th, 1934.

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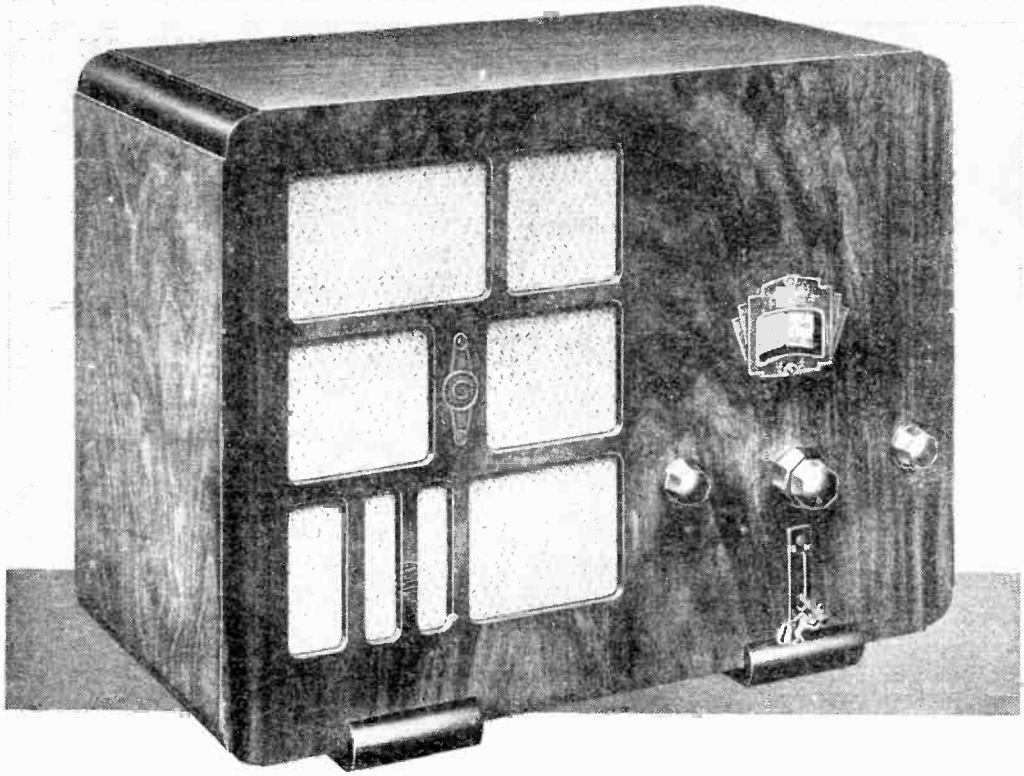

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RADIO NOTES & NEWS

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Britain's Loss.

BY the death of Sir Edward Elgar we have lost the presence of a composer who, if not our greatest—it is a matter of opinion—seemed to be truly the *national* composer.

There can be no doubt that his admirers were multiplied enormously by the help of broadcasting, and it is pleasing to think that that man to whom recognition came so tardily eventually had the supreme happiness of knowing that his work was being enjoyed by millions of people and not merely by a small group of highbrows.

Japanese Radio in Africa.

IT is alarming to find that Japanese radio sets, parts and valves have found their way into the South African market, where the indigenous traders cannot meet the competition.

Why? Well, the prices run about a third of British and American goods, and valves normally costing £1 are offered for 4s. 6d.

The South African Association of Radio Industries has resolved not to handle radio goods of Japanese origin and that mechanics employed by its members will be dismissed if found "servicing" Japanese sets.

News from (and for) Norway.

E. BJÖRKMANN (Oslo) kindly informs us that the mysterious station which was heard between 40 and 45 metres, and which we suggested was Oslo, is actually the Oslo short-wave relay station (Jelöy), which relays for northern Norway and for Norwegian sailors in the Antarctic. He asks for constructional details of a short-wave receiver.

We recommend our "Short-Wave Two," particulars of which appeared in "P.W.," July 22nd, 1933, a copy of which (if any are left) can be got from the Back Number Dept., Bear Alley, Farringdon Street, E.C.4, price 4d., post free.

"S.T.500" in Scotland.

T. C. A. (Kilmaurs), in a note of praise for the "S.T.500," rises almost to the lyrical height of Burns. He says that, although he has assembled dozens of receivers, he has never experienced the equal of this one, and as for getting American stations—pooh! he can tune in from six to nine of them any night at good loudspeaker strength.

Another sentence I liked immensely was: "I have been a reader for five years and have been much the better for it." That's success!

Their Hearts' Desire.

IN "P.W." for March 3rd my revered fellow-scribe, W. L. S., announced that he was enlarging his section. When I read the news a beatific smile played for a moment on my bearded lips, for, thought I, "that will stop the spate of letters from readers who positively demand more short-wave stuff"—letters which are frequently passed to me as though I had W. L. S. in my pocket.

Well, I congratulate you for getting your hearts' desire and W. L. S. on his need for a larger fountain-pen.

Short-wave Information.

J. R. (Brentwood) submits a list of amateur stations abroad which he has received telephonically, and asks whether they would be interested if he applied for confirmation. They would be tickled to death.

I can see from his other questions that he is set upon getting into the short-wave game in earnest, and therefore I can do no better than to recommend him to take his troubles about codes and call-books to Mr. Arthur Bear, 10, St. Mary's Place, Rotherhithe, London, S.E.16, who is a representative of the International Short-Wave Club. Other aspirants, please note.

From a New Zealand Reader.

J. RAMSAY, c/o 282, Dominion Road, S2, Auckland, N.Z.—which, I gather, is a place where J. R. is a hospital patient—asks for old radio papers. It might be done, J. R., but when you ask also for sheet music and give me a list of the pieces required—there are about thirty!—I think that you are unaware of the prevailing depression.

Besides, if you are studying music I don't think that those pieces are, to judge from their titles, likely to let you very deeply into the secret. Why not concentrate on radio instead of approaching music through its frothier specimens? Good luck and better health!

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—THE LAST CHANCE

What is a "T R"?

IN his reply to V. G. W. (page 1040, February 24th issue), W. L. S. suggests that V. G. W. misread "D E" as "T R." Whilst I agree that this is possible, may I suggest that V. G. W., who is trying to learn Morse, has been listening to ships working with coast stations, and has also really heard "T R," the abbreviation for "Time Rush"?

I do not know why "Time Rush" is so called; it consists of information which a ship has to give the coast station when it first gets into wireless communication with it, such as course, speed, position, number of messages to be sent and so on. No doubt V. G. W. will verify this.

The Fickle Heaviside Layer.

DR. E. V. APPLETON told the Junior Institution of Engineers last month that, during his recent expedition within the Arctic Circle, he found that in thundery weather the reflecting power of the Heaviside Layer was abnormally high, and that, though it is 60 miles up, the layer could be thus affected by a storm near the ground.

He said also that sometimes the layer

(*Continued on next page.*)

THE WHITE CROSS MARKS THE SPOT

became comparatively non-reflective and would remain so for days. Hence communication from polar regions should be unreliable, and one wonders whether the Byrd Expedition will confirm this.

That's a Great Pity!

THE export of gooslys from Russia has been prohibited. Can such things be?

The goosly, I must explain, is a noise-maker akin to the zither, though it is bigger and stands on four legs.

When one was required for a B.B.C. programme it had to be borrowed from a member of a Balalaika orchestra. Imagine the wrath of the Board of Trade that its returns of goosly imports will be horrid blanks!

Only "Atmospherics"!

NEWS from Los Angeles, California: On February 20th listeners heard confused noises from a radio studio and attributed them to "atmospherics." Actually a lunatic was threshing round the studio, brandishing a knife; people were trying (a) to evade the knife, (b) to capture the madman. In the next room 150 ladies were listening to a cookery broadcast. This gives me an idea. Next time Mrs. Ariel "distinctly" hears a burglar downstairs I shall explain that "it's only an earthquake."

Valve Music.

THE electronde and other similar music-producing valve outfits have a very attractive tone, but I am repelled by them when I picture myself as a performer on them. This waving of the hands! I should feel that I looked like a professor of mesmerism at a fair or like a Spanish gent explaining something.

Therefore I am pleased to learn from "Radio-Craft" that there is now an "electro-musical trombone," which is a sort of electronde, but is played by sliding a lever along a scaled rod—very much less of the Svengali touch required!

On the Spot.

I OBSERVE a report to the effect that the amplifier which has been installed in the Houses of Parliament, in an attempt to render the speeches of the noble lords audible, is located on the very spot in the cellar where Guido Fawkes put the gunpowder which didn't go off.

Well, well—that's fine! How history does repeat itself, to be sure! I remember that Guido marked the spot with a cross in chalk, so that it could be used again. And the Marconi people have found it, even though the place has been rebuilt since the good old days.

Sunday Broadcasts.

MUCH as I admire the B.B.C., I really must agree that it has quite the wrong idea about what Sunday programmes should be. It is elementary gumption to realise that Sunday is *the* day when most people have most time in which to listen, and that therefore the greatest possible pains should be taken to make the programmes real treats. This could be done without omitting a service.

Shortly I shall construct my model Sunday programme and ask for your opinion of it. Meantime, a dull radio Sunday does not annoy me, because it gives me time for catching up with my reading.

"That's a 'P.W.' Set—That Was."

W. W. (Manchester), bandmaster, solo euphonium and 6-volt diehard, comes forward with a friendly reproach which is at the same time a supreme tribute to our technical staff.

He complains that our designs are published so much in advance that they are obsolete before he can get the components for them, and he instances a certain make of coil and a new type of valve.

No doubt those concerned here will give this point the consideration which it merits; but W. W. knows that we cannot control the output and distribution of components.

A Practical Testing Station.

SOME time ago the Marconi Company established at Mersea Island a station for testing the effects of sea water, sea air, ozone and sunlight on paints, metals, etc., a matter which is of vital moment to manufacturers of apparatus destined for marine and tropical use.

The scope of the station has now been extended, and its services will be at the disposal of the public authorities, manufacturers and engineers who desire independent reports on materials tested under natural conditions.

When is a "Howler" Not?

E. A. W. (Nottingham) thinks he has found a "howler" in someone's explanation of what happens when a loop of wire cuts lines of force: "... A current will flow along the wire and generate a definite voltage between the two ends ... which varies with the current flow."

E. A. W. says that a current cannot flow in a loop whose ends are open—hence he has forgotten Hertz's famous observation of the spark across the gap in a metal ring, which set him on the track of wireless waves.

Jumping at Conclusions.

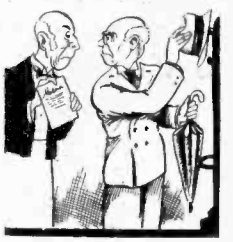
BUT to return to the case in question. Who said that the loop's ends were open? Not the writer whose words are quoted; my friend E. A. W. jumped to that conclusion.

In some text-book *diagrams* the ends may, for simplicity, be shown open, but actually they are connected to slip-rings on which rest collectors, known as "brushes," which take the current and lead it to some external circuit such as a lighting system.

The induction or Rhumkorf, coil is an example of an apparatus in which current can flow in an open circuit—by bridging the gap by means of the spark.

Piece of My Mind.

NO doubt you have often heard people say: "Well, if you don't like the programme you can switch off." Has it ever occurred to you that as an argument that is about as useful as the vituperation in which some unsuccessful debaters take refuge? Personally, I consider it childish.



One might as well say: "If you can't get your number, don't try to telephone"; or "If you don't care for the menu, don't eat." We buy our sets and pay our fees for the pleasure of listening, not for the privilege of switching off.

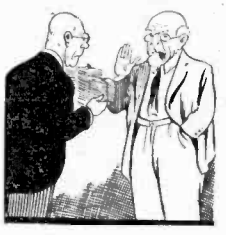
"A Fair Cop."

MY sleuth brigade, on their mettle because of my recent caution not to let zeal outrun discretion, have been firing "howlers" at me harder than ever. No less than seven of these beagles sent me news of the Scottish editor who published an article containing: "The B.B.C. must think in terms of Scots if it is to get on." The poor struggling B.B.C.!

A London "daily's" wireless correspondent said that "ultra-short wave work" is "experiments on channels with frequencies of from a fraction of a metre to ten metres." How long are the kilocycles?

This Week's English Lesson.

WHILST ploughing through a batch of American radio papers I read that somebody named Chic Sale had refused an offer of a broadcasting contract because "the kale was too slight." I asked an American what slight kale has to do with radio.



He replied that "too slight" meant "insufficient," and that "kale" is "long green" or "spondulix." Questioned further, he said that, in plain American, these words mean "jack." I suppose he means, in plain English, "oof"!

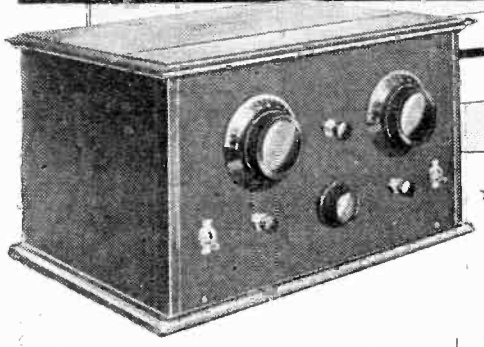
Cheerio to Henry.

SO Henry Hall now enters his third year as purveyor-in-chief of dance music, and he is firmer in the saddle than ever. The reasons for his success are his quiet confidence, his efficiency, his complete freedom from the B.B.C. bacillus of dictatorship, and, above all, the fact that he is sensible enough to keep his ear to the ground.

His motto might well be, "We strive to please." Just as a wise man will change his views, so Henry is big enough to change his tactics. So here's luck to him—and "his boys"—and many more years of his tuneful company.

ARIEL.

BIFOCAL THREE — THE INDUSTRY'S GREATEST ACHIEVEMENT



The new method of selective reception, focused radio, has already aroused nation-wide enthusiasm, although the first details were given to the public only a fortnight ago in this journal.

Below we tell how this remarkable tuning development has proved its superlative programme-separating qualities to constructors and radio enthusiasts in all parts of the country.

THE success of the "Bifocal Three" receiver is complete. From all parts of the country we are receiving reports to the effect that "Bifocals" are being built by the thousand, and that the interest created by this 1934 wonder set is absolutely phenomenal.

While we are pleased—very naturally—that "P.W." was the medium through which the very first details of this amazing set were made known to the world, we, on our part, hand the laurels to that enterprising group of manufacturers representing the leading component interests of this country for having so skilfully designed and produced it. Their timely intervention in a problem which had every appearance of being practically insurmountable has earned for them the gratitude of enthusiastic constructors all over the country, and we congratulate them.

Distant Listening Saved.

But for the introduction of this great new principle of focused radio there is little doubt that distant listening for many thousands of listeners would by now have been practically impossible, for it becomes more and more apparent, as time goes on, that the problem of ether chaos cannot be solved by Europe's broadcasting authorities alone.

That much may be deduced from some facts which have just come to light concerning a conference of experts which was called to Geneva at the beginning of this month with a view to finding solutions to the difficulties which have arisen as a result of the inaugration of the Lucerne Plan.

A Timely Introduction.

Neither Russia nor Luxembourg, whose failure to abide by the recommendations of that plan is largely responsible for the present chaos, replied to the invitation to be present at Geneva, and the position is therefore much the same as it was before. Moreover, there are many who believe that it is still likely to be.

Frankly, until complete unanimity is reached by all the countries concerned, and not, as at present, by only a certain percentage of them, the hope of finding a solution acceptable to all parties would appear to be remote in the extreme.

That is why the introduction of focused radio is so timely, and that is why the daily Press of this country has been quick to recognise the advantages of tackling the problem from the receiving angle.

A typical example of the way in which focused radio has been acclaimed as a solution to the interference problem comes from the March 1st issue of the "Daily Sketch." Under the heading of "Focus Your Radio—and End Jams," "Grid Leak," the well-known wireless authority, wrote: "What might be termed 'focused radio' is the latest and greatest advance in the wireless science. By means of this new discovery it is claimed that interference can be conquered.

Focusing the station, to free it from interference takes only a moment, though it is extraordinarily effective.

"The Lucerne wavelength allocation plan has done much to clear up the troubles caused by interference with perfect wireless reception, but the failure of certain countries to abide by the recommendations of the conference has meant that if the transmission required has been subject to interference nothing could be done about it.

Every Station Stands Out.

"This position is now changed by a device, simple to use, by means of which broadcasting stations can be tuned in with dead sureness and then focused out of the surrounding jangle, much in the same way as a pair of field-glasses focus a desired object and make it stand clear of all else.

"Focused radio does to distant stations precisely what binoculars do to distant scenes. It enables you to bring each and every one of them into focus. All the transmission detail of the station on which you are focused stands out in brilliant relief from the multiplicity of programmes which to the set of yesterday are a mere blur.

"Each and every station has a 'line of vision' of its own, and now the owner of a wireless receiver, not Europe's broadcasting authorities, can be master of the situation.

Interference-Free Reception.

"The new method comprises two tuning coils, constructed on an entirely new principle, and a simple focusing adjustment will provide interference-free reception for all listeners.

"The inexpensiveness of this astonishing new principle, coupled with the efficient way in which it functions, provides strong grounds for thinking that it will ultimately be adopted in the design of all new receivers, whether commerical or home constructed."

"Grid Leak" is right. The paramount features which he stresses provide very strong grounds indeed for thinking that focused radio will ultimately be adopted in the design of all new receivers. How soon commercial-set manufacturers will

(*Continued on next page.*)

COMPONENTS USED IN THE "BIFOCAL THREE"

2 Varley "Bifocal" coils.
2 J.B. ·0005-mfd. Popular Log slow-motion tuning condensers.
1 J.B. ·0003-mfd. differential reaction condenser.
1 Ferranti A.F.4 L.F. transformer.
1 Ferranti 50,000-ohm resistance (new type).
1 Ferranti 5,000-ohm resistance (new type).
2 Bulgin type S.105 switches.
2 Bulgin standard H.F.9 chokes.
1 Benjamin "Autocontrola."
2 Benjamin 4-pin valve holders, "Vibrolder" type.
1 Benjamin 5-pin valve holder.
1 Benjamin push-pull on-off switch (type with terminals).
1 Dubilier 2-mfd. fixed condenser, type BB.
2 Dubilier ·0002-mfd. fixed condensers, type 620.
1 Dubilier 2-meg. grid leak, 1-watt type.
1 Dubilier 100,000-ohm resistance, 1-watt type.
1 Westinghouse "Westector," type W.6.
1 T.C.C. 2-mfd. fixed condenser, type 50.
1 T.C.C. 1-mfd. tubular fixed condenser, type 250.
1 T.C.C. ·0001-mfd. fixed condenser, type 34.
4 Belling-Lee type R terminals, engraved "A," "E," "L.S.+" and "L.S.−."
2 Belling-Lee terminal mounts, catalogue number 1039.
1 Ebonite panel, 12 in. × 7 in.
1 Plywood baseboard, 12 in. × 10 in. × ¾ in.
1 S.G. anode connector.
4 Wander-plugs, engraved "H.T.+1," "H.T.+2," "G.B.+" and "G.B.−."
2 Accumulator spades.
1 Fuse-type wander-plug (black for H.T.−).
2 10-ft. coils of insulated connecting wire.
Flex, screws, etc.

BIFOCAL THREE—
The Industry's Greatest Achievement

(Continued from previous page.)

adopt the idea is a matter for conjecture, but the fact remains that for the present, at any rate, this great new principle is available *only* to home constructors.

The Industry's greatest achievement! How easy it is to be eulogistic in print! Yet how many people realise the magnitude of this great development? Let us try to review it for a moment or two in relation to the problems which have baffled solution by the cream of Europe's broadcasting experts in conference both at Lucerne and Geneva.

The paramount fact on which all these international discussions have to be based is that for satisfactory reception it is imperative that each and every station should be allocated a "channel" 9 kilocycles wide.

Insufficient Room.

If the lower and upper extremities of the broadcast band are considered for the purposes of this explanation as 200 and 600 metres respectively, between 200 metres—equivalent to 1,500 kilocycles—and 600 metres—corresponding to 500 kilocycles—there are approximately 111 "9-kilocycle channels." *But there are already more medium-wave stations in Europe than there are "9-kilocycle channels" between* 200 *and* 600 *metres!*

Even if all the countries of Europe were content to abide by the recommendations of a representative committee of experts the problem would be difficult enough. But when certain of them refuse point blank to have anything to do with it the position becomes practically impossible.

Thus, short of an extension of the present broadcasting band, which is impossible on account of the requirements of commerical and governmental stations, the only hope of at least partial solution is on the receiving side.

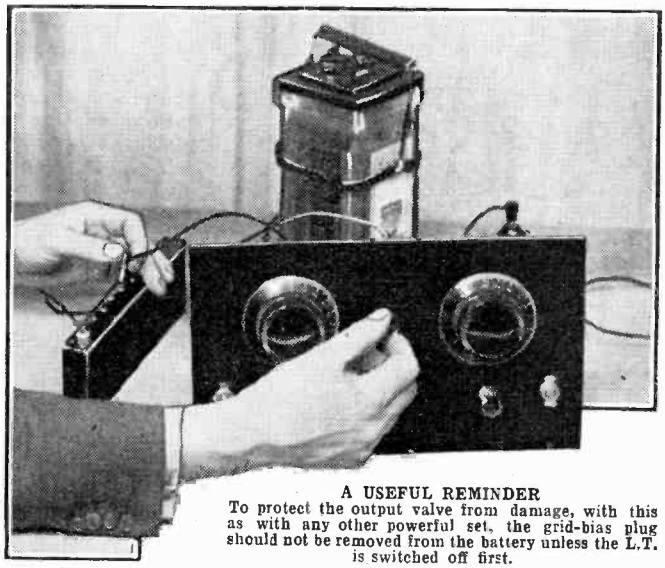
Already a Firm Favourite.

It is desirable to stress that point of partial solution, for neither this set nor any other can sort out a bad heterodyne when the trouble is directly due to a station being appreciably off its allocated wavelength. But, apart from that, the principle of focused radio does definitely give you a chance of sorting out a lot of the muddle, and that is why the "Bifocal Three" has so rapidly established itself as a firm favourite among constructors in every town, village and hamlet throughout the country.

It *is* the Industry's greatest achievement, and all credit is due to the manufacturers concerned for having so wholeheartedly tackled the problem in the interests of British listeners generally. The response to their campaign is encouraging, to say the very least of it, but their efforts to raise the general standard of reception in this country are not yet over.

Before this month is out there will not be a single reputable dealer throughout the country who cannot supply free copies of the "Bifocal Three" constructional chart, the chart which was presented to "P.W." readers over a fortnight ago. Window displays are being arranged in every principal town in the United Kingdom, and, great as has been the response already, it is as nothing compared with what is to come.

Those whose sets are relatively old-fashioned will be scrapping them in favour of this latest wonder, while those who have only recently built new sets will be anxious to convert them.



A USEFUL REMINDER
To protect the output valve from damage, with this as with any other powerful set, the grid-bias plug should not be removed from the battery unless the L.T. is switched off first.

That is another important aspect of focused radio. It lends itself admirably to the adaptation of existing designs, and in most cases the modification will require only the addition of "Bifocal" coils and switches. The whole question of conversion is dealt with in a leaflet which has just been published by Varley and which is available free to "P.W." readers on application to Messrs. Varley.

If *you* want better radio, then you, too, must join in the chorus which is being echoed round the land: "Be wise—Bifocalise," for sooner or later you will have to!

WATCH YOUR EARTH
Details of a puzzling fault which points a moral.

THE heading to these paragraphs would seem to indicate that I intended giving old-fashioned advice. But a recent experience suggested the idea.

I had occasion to look at a three-valve A.C. set which was very much below par. I examined the aerial, saw that the earth was truly sunk into the ground, and then tried all I knew in pepping up the set. It was of no avail.

Finally I decided to make a thorough investigation, so with the set still switched on I disconnected the earth wire. Immediately the volume jumped. At once I thought that the ganging was at fault, so I connected the earth again and retrimmed. It was still no use.

It did not seem possible that the earth could be at fault. However, I decided to take a wire from the set to the earth terminal of a three-pin plug which happened to be installed in the house. On using this earth the results were normal.

The only theory I could suggest was that the earth was making a good connection, not with the surrounding soil, but purely to the foundations and walls of the house. The aerial was an indoor one, and as the walls were seemingly well connected to the earth wire, the aerial effect was being counteracted by the earth in a manner which I did not attempt to explain.

The earth tube had been well watered, yet the effect persisted. So look to your earth.

G. L.

REALISTIC REPRODUCTION

The Editor, POPULAR WIRELESS.

Dear Sir,—Mr. Sturrock, in your issue of Feb. 10th, questions my statements to the effect that straight-line reproduction is not necessarily the most faithful to the orginal, judged by the actual impression received by the listener. As my remarks on this subject were merely the introduction to a constructional article it would obviously have been out of place to have gone fully into the rather difficult theory; but if Mr. Sturrock or anybody else cares to pursue the thing farther he can do so by reading an article by Mr. F. M. Colebrook, of the National Physical Laboratory, in "World Radio" dated February 2nd, 1934.

Mr. Sturrock does not take account of the fact that very often people do not want to listen to a programme even at the same *apparent* volume as the original, and it was to take care of this that my system of control was intended. Also it is not very clear what Mr. Sturrock means by hearing the original at less volume. Anything heard at less volume than the original surely cannot be the original.

Yours faithfully,
M. G. SCROGGIE.

THE VALVES AND BATTERIES FOR THE "BIFOCAL THREE"

S.G. Valve. — Cossor 220 S.G.

Detector Valve.—Cossor 210 H.F.

Output Valve.—Cossor 220 P.T.

* * *

H.T. 120 volts.—Exide Type H.1074.

G.B. 16½ volts.—Exide Type H.1002.

L.T. 2 volts.—Exide Type DMG.

A HOME-MADE VALVE TESTER

How to build a cheap, simple, but completely effective unit that will enable you to check up your valves in a few moments.

Designed and Described by L. H. THOMAS.

THERE nearly always comes a time when the home constructor breaks the tenth commandment. Speaking purely from personal experience, I should say that the thing I have coveted most often is a device that would, at one simple operation, tell me which valve of my "super-what-is-it seven" is misbehaving itself, and why.

When a set—and especially a modern set—starts giving trouble the first thing that one wants to find out is the approximate locality of that trouble. Common sense helps a great deal, but there are many cases in which common sense unless backed by a good deal of sound technical knowledge, will not help us out.

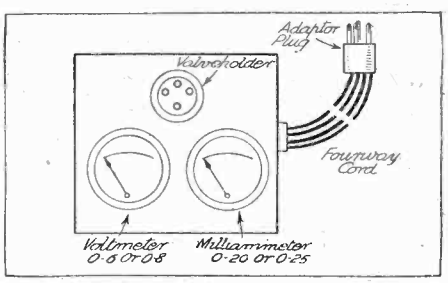
Cost Cut to a Minimum.

This being so, in accordance with the spirit of the age we invent a machine to do it for us. The little tester that I am about to describe has saved me many anxious moments, cost me next to nothing and took about an hour to construct.

The elaborate commercial set-testers, admirable though they are, are priced at a figure well beyond the pocket of the average dabbler in radio. Even a home-made imitation of them would be a costly affair. So I have cut the thing down to a bare minimum.

What are the two things that we want to know most of all about a valve, to say whether it has a chance of working properly in the set? I should say, without any hesitation, that they are the filament volts and the anode current. These can be measured by means of a voltmeter and a milliammeter, it is true, but not without a considerable amount of diving into the set, not to mention the removal of sections of the wiring.

A COMPACT UNIT



Two inexpensive meters form the main components in the tester described on this page.

The tester seen in the diagram employs these two instruments, mounted on the lid of a small wooden box, together with a valve holder. A four-way cord leads from the box to an ordinary four-prong adaptor.

All that one has to do is to remove the valve from its holder, insert the adaptor in place of it and place the valve in the holder on the tester itself. The two meters then read simultaneously—filament voltage on the left and anode current on the right.

The latter is unquestionably the more useful; but funny things sometimes happen to filament voltages, particularly if the set contains questionable wiring and dirty L.T. switches, not to mention long, straggly lengths of flex ending at corroded accumulator terminals!

The wiring of this little unit, as shown in the diagram, is perfectly straightforward. The leads that are connected to the "filament" pins of the adaptor simply go straight to the voltmeter and to the filament legs of the valve holder. If the meter is of the moving-coil type, provision may have to be made for reversing its polarity easily, since all the valve holders in the set may not be wired up in the standard manner—i.e. with the L.T.— pin on the same side.

The Anode and Grid Connections.

The lead from the "anode" pin of the adaptor goes to the positive side of the milliammeter, the negative side of which goes to the "anode" leg of the valve holder mounted on the tester itself. The lead from the "grid" pin simply goes straight to the "grid" leg of the valve holder.

The anode-current reading should, naturally, be carefully compared with the maker's figures. If it is too high, in ninety-nine cases out of a hundred the fault will be found in the grid-bias battery—a component which, on account of its long life, is apt to be overlooked, if not forgotten.

If the figure is too low the trouble *may* possibly be an excess of grid bias, but is more likely to be due to faulty emission if the valve is a veteran. Naturally, the anode-current readings won't mean anything at all unless the filament voltage is at the normal figure.

Endless Possibilities.

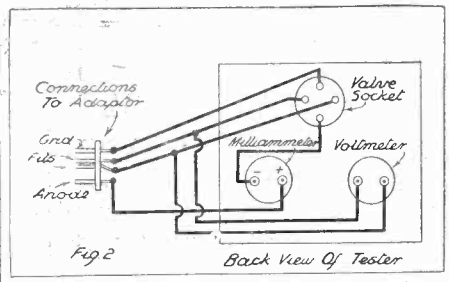
Incidentally, the anode-current reading is often useful in the case of a last-stage valve, for checking the presence of distortion. The well-known kicks tell their own story; they generally cry "Overloading" in a very loud voice. Remedy—reduce the volume a little and see if they are still there.

Readers of an inventive turn of mind will see endless possibilities in this idea. It is, for instance, only one step further to install on the tester a good high-resistance voltmeter for the measurement of anode voltage. This will have to be connected between the lead coming from the "anode" pin of the adaptor to one of the filament pins.

Effect of Anode Resistances.

It is no good trying to do this job with a cheap voltmeter, however, as, if there are any coupling or decoupling resistances in the anode circuit of the valve, an entirely false reading will be given. A valve with 100,000 ohms in its plate circuit may have an actual potential of 60 volts on the anode, but a cheap, low-resistance voltmeter might very well give a reading of 15 or 20.

EASY TO CONSTRUCT



Very few connections are required, as this underpanel wiring diagram shows.

The two "essential" meters, however, need not be expensive instruments, provided that they are reasonably accurate.

The tester, as it stands, is not suitable for use with A.C. valves. That involves a few alterations and the installation of a good A.C. voltmeter. The cathode lead, too, has to be dealt with, and one sometimes finds a few snags in these cases.

"SELECTIVITY WAS AMAZING"

To the Editor, POPULAR WIRELESS.

Dear Sir,—Having raked out an old POPULAR WIRELESS, dated June 24th, 1933, I thought I would build the "Economy Three" to see what kind of set it was and to see if it was as good as it was painted. After a few hours' work I had the set completed, and no sooner had I switched on than there was Budapest at full loudspeaker strength. Selectivity was amazing. London Regional occupied only three degrees of a 180-degree dial.

Being a regular reader of "P.W.," I have built many of the sets which have been described from time to time, and not yet have I once been dissatisfied with the results.

I usually buy all the radio periodicals, but never have I been so satisfied with these as with POPULAR WIRELESS.

Wishing your journal every success in the future as in the past.

Yours truly,
E. C. B. JARVIS.

7, Woolwich Road, Greenwich, S.E.10.

THE MIRROR OF THE B.B.C.

THOSE "HOME-MADE" PROGRAMMES

Boycotting Newspapers—An Easter Revue—Talks from Foreign Capitals—The Week Abroad.

REFLECTIONS BY O.H.M.

MEMBERS of the programme staff of the B.B.C. are notoriously underpaid. In the past they have been able to make up their trifling salaries with fees for programmes prepared in their own time. This extra source of revenue is now to be denied. No member of the programme staff of the B.B.C. is to get anything more than his or her salary.

Unless pay is adjusted accordingly, this will cause a good deal of individual hardship. It is also likely to have an adverse effect on programme standards. Some of the best peaks of broadcasting have been the private brain-waves of members of the staff.

The B.B.C. to Counter-Attack.

I hear interesting news of a change of attitude on the part of the B.B.C. concerning Press attacks. It is stated that the B.B.C. has decided no longer to ignore these attacks when there is evidence that they are due to the instruction of newspaper proprietors. The new policy is to counter-attack. The papers concerned are being put on the black list. No one connected with them will be allowed to broadcast, and all references will be carefully censored. Competing newspapers will be given special notice. Offending proprietors are being carefully watched.

Denis O'Neil as Composer.

The soloist with the B.B.C. Theatre Orchestra, conducted by Stanford Robinson on March 14th (London Regional), is that genial Irish singer, Denis O'Neil, who is to give three groups of songs. He is to appear in a new light in this programme, two of his songs having been written by himself. They are "My Sheepdog and I" and "Nothing for you to-day," and this will be their first broadcast.

Regional Orchestras.

The move to restore Regional orchestras of the B.B.C. is gaining ground. It is not intended, however, to recreate complete studio symphony orchestras. The plan is to co-operate with local authorities in order that a good symphony orchestra may have full-time employment throughout the year in each region. In Manchester, for instance, the Hallé Orchestra will benefit in this way; in Birmingham the local municipal orchestra will benefit.

This is an excellent plan from every point of view. It would greatly improve the musical quality of Regional programmes, it would provide much-needed employment for a considerable body of musicians, and it would greatly enhance the prestige of the B.B.C. throughout the country. Such a move, also, would be an admirable preparation for impressing any parliamentary committee of inquiry which may be appointed to examine the B.B.C. next year.

Ernest Longstaffe's Birthday.

Listeners will simply clamour to send birthday greetings to Ernest Longstaffe on Friday, April 6th, the day on which he is to produce his new revue for London Regional, called "Easter Eggs: a Sitting of Idle Idylls."

"A PLAY FOR THE MICROPHONE"

A photograph of the local control-room which commands a view of most of the studios in the Dramatic "block" at Broadcasting House.

The show opens with the whirring of a cuckoo clock, which was given to Mr. Longstaffe by his father when he was six years old. In addition to writing the book, Mr. Longstaffe has composed the music, and he will also produce the show.

He has, however, had the collaboration of Edward Lockton, who has written a song, "Gentlemen, Good-night," which will conclude the programme. The revue will be repeated for National listeners on Saturday, April 7th.

The Grand National.

Mr. R. C. Lyle and Mr. W. Hobbiss, who have been sharing the task of describing the Grand National since 1930, will do so again on Friday, March 23rd, from their respective positions at the Grand Stand and the Canal Turn.

Two commentators are required because of the impossibility for one man at the grand stand to distinguish the horses nearly a mile out "in the country."

Clapham and Dwyer for the Children.

Mr. and Mrs. Clapham and Mr. and Mrs. Dwyer are to make their first Children's Hour appearance on Saturday, March 24th, a day of the week on which, fortunately, many grown-ups will also be able to listen.

It may not be generally known that Clapham was formerly a barrister's clerk and that Dwyer was a commercial traveller. The story goes that the famous partnership was started over a little light luncheon when the two met in a hostelry.

They had not been long on the halls when they were invited to broadcast, which they have been doing regularly since 1926.

"The Week Abroad."

It having already been stated in Parliament that Mr. Vernon Bartlett's regular series of talks are to finish, listeners may like to know that their place will be taken on Thursday evenings, from April to June, with relay talks from the different capitals of Europe.

These talks will continue to be given under the title "The Week Abroad," and they will be arranged, as far as possible, to coincide with events of special interest or significance in the various countries. The speakers will all be experts on foreign affairs.

Mr. Maxton's Point of View.

Mr. James Maxton, most fiery of all members of the British Parliament, is to broadcast on Friday, March 23rd. He is taking part with Sir Alexander McEwen (ex-Provost of Inverness) in a debate in

(*Continued on page 25.*)

THE LISTENER'S NOTEBOOK

Comment and criticism on the programmes.

I HAVE heard lots of favourable comment on James Douglas' talk. Such a remarkable talk deserves recognition, of course. I am not a little surprised, however, that there has been no protest against it from certain quarters. The fact is there is a growing public opinion completely in sympathy with the sentiments expressed by Mr. Douglas.

Another satisfactory point about this broadcast talk is that it was allowed. And wasn't the same freedom given to Mr. Michael Roberts in his talk a few nights later in the "Whither Britain?" series?

* * *

The other recent Talks sensation, of course, was provided by Mr. William Ferrie who made use of his privileged position in front of the microphone as representative of the working man to broadcast a personal protest against the censorship of passages in his manuscript.

The full facts of the case will probably never be known. The B.B.C. says that the censored talk was in Mr. Ferrie's hands 48 hours before the broadcast and that he made no protest at his final rehearsal. Mr. Ferrie, on the other hand, maintains that the alterations were made at the last minute.

Whatever the facts, it remains that no broadcast speaker finds it easy to depart from his manuscript. It is so simple to fade out the microphone!

* * *

I sat up for "Alibi from the Air." It was all very entertaining, chiefly because of the novelty of the idea behind it. A quite impossible story, of course. So impossible, in fact, that one doesn't want this sort of thing too often. Once in a while, perhaps, it is acceptable.

* * *

Having discovered some discrepancies in the story of the previous week's play, I listened carefully to "Alibi from the Air" for similar faults. Here, again, I discovered a point that made one realise that "facts" do not trouble authors over much. I refer to the prisoner's apparently truthful observation (in answer to a question) that the last time he was at a night club was three weeks previous to the date of trial.

This is hardly likely when we remember that the prisoner was being tried on a charge of murder at the Old Bailey—and therefore probably had been in custody at least a couple of months.

* * *

I had decided this week to do a bit of straight talking about that broadcast die-hard, the "Foundations of Music." My grouse isn't so much against the Foundations as against their bagging that 6.30–6.50 p.m. period every evening. This is really monstrous. It is usually such a good time for listening-in. An appointment somewhere in one's town isn't generally till a later hour. Most people are free at 6.30 p.m., and we always have to listen to the Foundations. We don't always want to.

I have been very angered lately by this monopoly. Let them keep the Foundations, by all means, but it is quite time now that that very valuable twenty minutes beginning at 6.30 p.m. ceased to be the exclusive property of what is, after all, an exclusive musical public.

* * *

The chamber works written by continental composers of the 16th and 17th centuries were much above

(*Continued on page 26.*)

THE H.M.V. "SUPERHET FIVE FORTY RADIOGRAM."

JUST a month ago—in POPULAR WIRELESS of February 17th—we told you about the new "Superhet Four Forty" which H.M.V. have produced. The tests of that fine receiver were definitely a pleasure. We have now had the added pleasure of trying out the radiogramophone adaptation of this same superhet chassis, which is issued under the name "Superhet Five Forty Radiogram."

The appearance of this instrument is fully indicative of the quality of performance. The walnut cabinet has been designed specially for the job, and the designers have spared no pains to make it ideal for its task, not only aesthetically, but also from the technical point of view. With the lid closed only one control is visible—obviously the volume control for the gramophone side of the instrument. The remainder of the controls are on the right-hand side of the motor-board.

The actual receiver has already been dealt with in some detail, but it may help prospective buyers if we briefly mention the chief points once more.

The circuit is a superheterodyne. That is a bald statement. Let us say, rather, that it is a superhet circuit which has emerged after long and extensive experiment from the laboratories of the H.M.V. engineers. That will explain why no interference is caused to your neighbours listening, why there is no sudden and irritating "blast" when passing local stations on the dial and why the reproduction amazes one at a first hearing for its fidelity and tonal balance.

The model which we tested was designed for A.C. mains. We listened for hum. We failed to hear a vestige of it! There is also a model for D.C. mains. We have no doubt but that this, too, is equally free from any form of unwanted "background."

On a Pinnacle of Its Own.

Those who wish to use the "Superhet Five Forty" as much for broadcast listening as for record entertainment will be glad to know that the new radiogramophone possesses to the full all the characteristics of its table "brother." We found the selectivity no less perfect, its "whistle-suppression" powers no less marked, its tone control no less useful.

But it is as a radiogramophone that the "Superhet Five Forty" must stand or fall. Not only does it stand, but it stands on a pinnacle of its own above others of its class. This is no extravagant flight of fancy. It is a fact. When the qualities of an H.M.V. superheterodyne design are allied to a gramophone from the H.M.V. factory the result cannot disappoint.

But to return to details. Needle scratch can be reduced almost to nothing by the tone control without appreciable alteration in balance. Output is sufficient even for dancing (and this form of exercise makes bigger demands on volume than many people think). The automatic stop makes operation a pleasure inst ad of a scramble between instrument and chair.

ITEMS THAT COUNT

1. **Superhet radiogramophone (incorporating mains aerial whistle suppressor, tone control, etc.), for use on A.C. or D.C. mains.**
2. **Electric turntable, gramophone volume control and automatic stop.**
3. **Manufactured by the Gramophone Company, Limited, Hayes, Middlesex.**
4. **Prices: For A.C. mains, 20 gns.; for D.C. mains, 21 gns.**

And the price? A mere twenty guineas. Almost any radiogram at this price would be value for money. But when it is remembered that this particular model is backed up by the prestige of one of the most famous firms in the country, it will immediately be apparent that the "Superhet Five Forty" is indeed a bargain that should not be missed.

The photograph at the top of this page shows Mr. Christopher Stone selecting records for a B.B.C. broadcast, on the H.M.V. "Superhet Five Forty Radiogram."

"THERE'S MANY A SLIP . . . . . ." By Eric O'Mahoney

I APPEAR to be the possessor of the world's lowest-capacity condenser. It came about in this fashion:

Looking around for a reaction condenser to try out an odd hook-up, I selected, from the spares box, a little air-spaced variable.

Its capacity was, to me, an unknown quantity, which was unfortunate, as the circuit plainly demanded a ·0003 mfd. Then a bright idea struck me. Why not calculate it? So much more scientific than just screwing it into place and chancing its being correct.

I expect you all know the time-worn formula:

$$C = 0.139K\frac{(n-1)(R_1^2-R_2^2)}{d}$$

Where K = dielectric constant (air = 1)
n = number of plates.
d = distance between a pair of plates in centimetres.
R_1 = radius in centimetres of a moving vane.
R_2 = radius in centimetres of the cut-out portion of a fixed vane.

This presumably gives the capacity of the condenser in billionths of a farad, or, to conform more closely to current laboratory practice, in micro-microfarads.

With the aid of a penny ruler—after all, I was only aiming at a rough approximation—I measured up the various dimensions. I performed the simple calculation. The going was so dead easy that I must confess to a few passing qualms. Nature is rarely like this.

And here I should like to offer a word of advice. If you're aiming at being scientific do the thing properly. There's no sense in giving the other fellow a chance to trip you up.

I repeat, I performed the measurements and calculations, not once, but many times. There was an additional reason for this. The result was amazing, stupendous! The maximum capacity of this little condenser was ·0000006 mfd.

I admit the 6 looked a little doubtful, but the row of noughts was most gratifying. And to think that the maker had failed to stamp his name on it!

. . . .

Later.—Have just made a dreadful discovery. My suspicions of Nature are confirmed. She had something up her sleeve. On one of the pillars of the condenser are engraved the symbols ·0003 mfd.

It's very perplexing, but, as Dr. Roberts, in a recent issue of POPULAR WIRELESS, so aptly remarked: "Where practice, in wireless, confounds theory, then confound theory," or words to that effect. Perhaps, after all, I'd have been wiser just to try the condenser out.

STATIONS WORTH HEARING

A review of the reception conditions existing on the broadcasting bands, showing where we have scored and where we have lost by the adoption of the Lucerne Plan in its current form.

By R. W. HALLOWS, M.A.

IT is rather interesting to sit down now and take stock of our gains and losses on the medium waveband since the coming of the Lucerne Plan. The gains are not yet quite complete, for there are a good many stations with channels of their own which are still working on low power.

By the autumn most of these will have new high-power transmitters in operation. The losses, on the other hand, are probably at their maximum now, for not a few stations that are now interfered with should come back to us when various problems of frequency control and of synchronisation have been solved.

Here are some gains: Beromünster, on 539·6 metres, is now always clear, though under the Prague Plan it was almost invariably heterodyned. Stuttgart, now on 522·6 metres, was formerly so near the London Regional that if the set were selective enough to separate the two, side-band splash was something more than a nuisance. This station was also generally heterodyned by Algiers.

Paris, Berlin and Hamburg

Paris P T T, another excellent station to-day, previously worked on a wavelength shared (and wandered into !) by half a dozen or more stations. Berlin, now on 356·7 metres, had hardly been heard for a year or so prior to January 15th, 1934, owing to interference. Hamburg, completely reliable to-day, used to be heterodyned night after night by Radio L L.

Monte Ceneri was rarely well received in pre-Lucerne days. At one time it worked on the long waves, regularly interfering with Kalundborg. Then it moved to 678·7 metres, a wavelength that few receiving sets can reach. It is now working on 257·1 metres, and if your set is selective enough to separate it from the London and West Nationals, two channels away, it can be heard well.

To the losses side of the account we must put the two Toulouse stations, each of which is now on a shared wavelength. I believe that in these cases, as in those of Strasbourg and the Poste Parisien, the trouble that we now experience is chiefly due to lack of synchronisation.

How We Have Gained.

If it does not disappear altogether the interference should become much less severe in time. The only other stations of importance that are no longer well receivable are Göteborg and Turin.

Göteborg shares a wavelength, and here again matters may improve. Turin, though it has a channel of its own, is next door to the London and West Nationals, and side-band splash is the bugbear.

Actually the loss of Göteborg and Turin is not a very serious matter, since the Göteborg programmes are almost always obtainable from Stockholm or Motala and those of Turin from Florence or Milan.

We seem, then, to have gained distinctly more than we have lost. We are six alternative programmes to the good as against three only to the bad, for Paris P T T often gives the same programme as Toulouse P T T.

To the losses, though, must be added, for the moment, two stations which are temporarily not worth listening to. These are Hilversum, which, at the time, is transmitting the Huizen programmes on 301·5 metres, and Heilsberg on 291 metres.

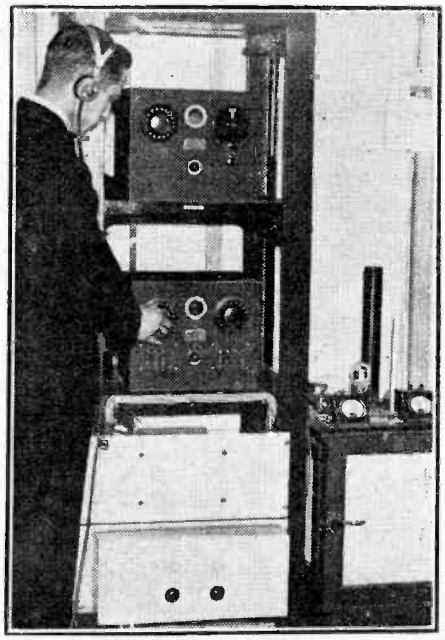
Those Wavelength Wobbles.

Cracow is working off its wavelength and heterodyning Hilversum. Heilsberg suffers from interference caused apparently by Barcelona E A J 15, which, as the latest U.I.R. report shows, has been going on just anyhow !

Perhaps the most marvellous piece of wavelength wandering recorded after the coming into force of the Lucerne Plan is that indulged in by Radio Normandie. The station started on roughly 226 metres, worked there for four and a half days, then went up to just under 227 metres. Then in one day it dived down to 205 metres. It has since wobbled about in the neighbourhood of 206 metres.

Almost as good are the feats of Juan-les-Pins, which in the course of seventeen days used three different wavelengths — 222·6, 247·6 and 240·2 metres.

CHECKING THE WAVEMETER



A view of the special multi-vibrator at the B.B.C.'s Tatsfield listening station. This apparatus is used to check up the wavemeters employed in keeping a watch on the wavelengths of B.B.C. and continental stations.

The records of the Spanish stations make rather sad reading. Barcelona E A J 1 is the only one that managed to keep to its wavelength, the rest having wandered like lost sheep.

One of Europe's worst wireless nuisances has always been Radio L L, which, as previously mentioned, used to heterodyne Hamburg in pre-Lucerne days. It is supposed to work on 360·6 metres, sharing this wavelength with Moscow IV. Actually it has never once been anywhere near its proper wavelength, and it has been interfering severely with Bucharest.

The only newcomer amongst stations this month is the new Poznan transmitter on 345·6 metres. The old plant had a rating of 1·7 kilowatts; the new one has ten times the power. Though it is not likely to become a reliable provider of entertainment, since it has the London Regional as next-door neighbour, Poznan is a station that the long-distance enthusiast will probably like to add to his bag. It is transmitting at the time of writing only during the mornings, but will shortly come into full-time use.

There is a certain amount of improvement to record on the long waves, and it is to be hoped that the U.I.R. Conference on the subject will have successful results.

Huizen has background interference on about two evenings each week on the average. Radio-Paris is still interfered with as a rule, though good reception is occasionally obtainable.

Between 200 and 300 Metres.

The Deutschlandsender, Warsaw, Motala, Luxembourg, Kalundborg and Oslo are generally well heard. Motala, Kalundborg and Oslo are gains since last month.

The medium waveband is very satisfactory between just over 300 and 549·5 metres. Between 200 and 300 metres there is, unfortunately, a great deal of heterodyning and jamming. The only stations receivable clear of interference in this region are Rennes, Juan-les-Pins (which has adopted the wavelength originally assigned to Luxembourg), Trieste, Frankfurt and Bordeaux Lafayette.

The upper part of the medium waveband is about as good as it could be, containing as it does a score or so of stations which come in with good volume and fine quality evening after evening. The wise listener uses mainly the band between 310 and 549·5 metres for his foreign listening if he wants to receive transmissions of genuine entertainment value.

Near the top of the band are five stations which invariably provide magnificent reception. These are Budapest, Beromünster, Athlone, Stuttgart, and Vienna. Florence is almost as good as any of them, whilst Brussels No. 1, Prague, Lyons P T T and Langenberg seldom fail to furnish first-class reception.

Working Well.

Söttens would be excellent if it were not next door to the North Regional; as it is, that old enemy of reception, sideband splash, spoils the programmes when the British station is transmitting speech.

Belgrade is fairly well heard on certain evenings, and is sure to prove a fine station when the new transmitter comes into action, as it will within a month or two.

Paris P T T is generally good, though an occasional heterodyne occurs.

On the whole, then, the position is pretty satisfactory, though admittedly a selective receiving set is necessary nowadays for good results. With all its shortcomings, and they are many, the Lucerne Plan is working well.

ABOUT YOUR RECEIVER

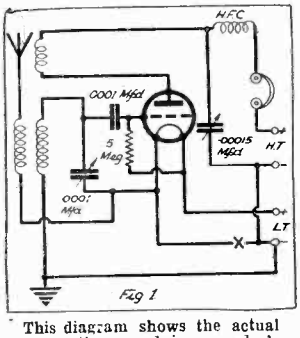
That layout is every bit as important in short-wave work as the particular circuit used is the theme of this article by W. L. S.

EVERY week, with the utmost regularity, I find in my pile of correspondence a letter from a reader who says: "I always find that the layout is more important than the circuit for successful short-wave work." Not always in so many words, of course, but always with the same meaning.

This is so absolutely true that I want to amplify one or two of my remarks in last week's notes. You may remember that I stressed the importance of connecting the grid coil *directly* across its tuning condenser. I mentioned sets in which the wire from the moving plates of that condenser, instead of going straight to the earth side of the grid coil, first went for a walk right round the set.

Since then I have been at some pains to discover just how bad the effects of this procedure may be on short-wave work, and in the course of my travels I discovered the extraordinary specimen shown in Fig. 1. That circuit diagram is an absolutely literal "translation" of the wiring of a reader's set.

BAD WIRING



This diagram shows the actual connections used in a reader's set which proved unstable.

You will notice that the "earth" side of the tuning condenser is taken straight to one leg of the filament, but the "earth" side of the coil which the condenser is supposed to tune is taken straight to the earth terminal, whence it finds its way round to the L.T.— terminal. After leaving this for a circular tour round the baseboard, in the course of which it encounters a fine old 19th-century L.T. switch, it eventually gets back to where it ought to have been!

Some Common Faults.

Now, lest any sceptics among you may be saying, "Yes, but I bet the set worked in spite of all that," let me assure you that it *didn't*. It may have brought in a few stations, but that's not my idea of "working."

Hand-capacity effects were terrible. There was a large "blank spot" in the middle of the dial, over which the set would not oscillate; and, thanks to the reaction condenser having been "returned" to the H.T.— terminal instead of straight to the filament, the dirty L.T. switch introduced some very nasty noises. The cure for all this was so simple—just a rearrangement of two or three wires, resulting in a saving of about six inches of tinned copper—and the set worked like a charm without any further ado.

Fig. 2 shows my idea of what such a set should be. The thick lines represent the earth returns, facilitated by a metal panel and a foil-covered baseboard.

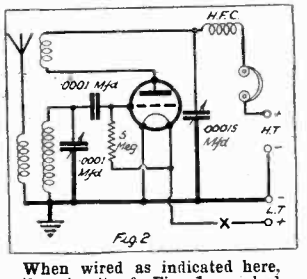
Low-Resistance Earth Returns.

When one does this there is no need to bother about that direct lead from the condenser to the coil (at least, not on the earth side). The moving plates of the condenser, attached to its frame, which is bolted straight on the metal panel, have as direct and as low-resistance an earth return as one could possibly devise. Precisely the same applies to the reaction condenser, while the bottom ends of both the aerial and the grid coil simply go straight to the foil baseboard.

I can honestly say that I have *never* met a case of trouble from hand-capacity effects in a set which has been sensibly dealt with in this way. As a matter of fact, the foil-covered baseboard is more useful than the metal panel. If the latter is dispensed with, however, the two sets of moving plates must be connected directly to the foil at the nearest possible point.

Now for a few thoughts about the actual circuit to use for short-wave reception. As I have said all along, the best circuit is the one that you are most familiar with. Your nearest short-wave neighbour doesn't get better results than you because he uses a Schnell circuit and you use a Reinartz; it's more likely because he has taken more trouble over the *details* than you have.

HOW TO DO IT



When wired as indicated here, the circuit of Fig. 1 worked perfectly.

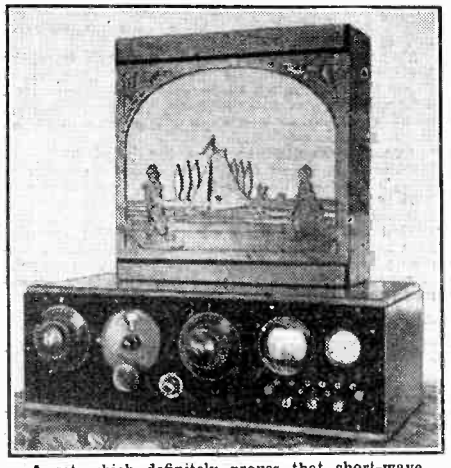
After all, there is only *one* detector circuit, fundamentally. All the different names have only been given to various modifications of it. Fig. 2 shows it in its simplest form—and, in my opinion, its best. I cannot emphasise too strongly the advantage of having one side of the reaction at earth potential.

A Well-Tried Circuit.

I don't stick to that particular circuit because I'm a die-hard—if anyone showed me a better one, and *proved* that it was better, I should scrap my ideas immediately; but I *do* know where I am with it, and anyone can make it work well.

The addition of a screened-grid stage (with which I shall soon be dealing) is the simplest possible job; and L.F. amplification, after all, is nothing to do with short-wave work. One ought to have a good L.F. amplifier "on the shelf" and finish all one's experimental sets with the detector. It's waste of good time to build a fresh L.F. stage into every S.W. set one makes.

AN ELEGANT DESIGN



A set which definitely proves that short-wave designs need not be eyesores. It was constructed by a reader in North-West India.

On the Short Waves—*(Cont. from previous page.)*

FROM the number of queries that have recently reached me on the subject of "man-made static" I am rather afraid that the situation is not improving. Nor can one hope that it will until some regulations concerning the use of "silencers" are drawn up and rigidly enforced.

H. H. (Wolverhampton) wants to know whether a small, amateurish, unscientific "doublet" aerial like that shown in the diagram can ever be any good as a means of reducing the noise-to-signal ratio.

I have often used one myself, H. H., and, although it is vastly preferable to put up one of the proper dimensions, an impromptu one like you mention is quite good.

Details of a "Doublet" Aerial.

The two horizontal arms of the aerial should each be a quarter-wave. In my own case I used a "doublet" for 20-metre reception and made each arm 5 metres (approximately 16 feet) long. But I found that arms not more than 7 feet long were quite good, although naturally one loses a lot of signal strength. But, after all, what good is signal strength to one if the noises are so overpowering that one can't hear the signals?

Incidentally, readers trying a "quasi-doublet" aerial like that in the diagram should note that they must use inductive coupling for their receiver. Although I have labelled the ends "earth" and "aerial," they should really be taken to a coil which is coupled to the grid coil. Sometimes it is an advantage to earth one side.

J. W. (Newmains) wants identification of a French-speaking station on about 14 metres, with an interval signal of a musical note (roughly G–C–G).

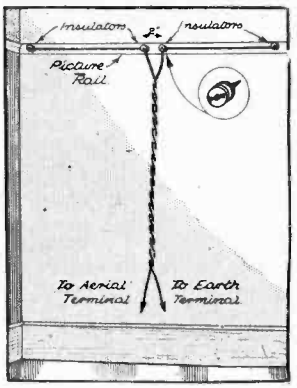
Will V. I. E. (Liverpool), whose address I am afraid I cannot trace, please make himself known to R. C. W. of the same town? The latter's address is Mr. R. C. Windsor, 5, Barnhill Road, Wavertree.

VERY EFFECTIVE

★ ★

A type of aerial which will prove helpful when static interference is bad. Even if the lengths of the horizontal wires are not exact multiples of the wavelength of the band to be received, the scheme is still worth employing.

★ ★



This same R. C. W. wants details of a "band-spread" arrangement for the 49-metre broadcast band, with a ·00004 midget condenser. Well, R. C. W., I don't call ·00004 a *midget* for short-wave work! Put in another nought and I might. A ·00004 across a biggish coil will easily cover the band of 30–50 metres.

My ideal band-spread arrangement is the conventional series of coils, tuned by something of the order of ·0001, with a really tiny condenser in parallel with it. If you can find the smallest condenser in your junk box, and strip off all its plates except one fixed and one moving—and then double-space those—you will have a band-spread condenser.

It is a good idea to reverse the usual procedure: equip your baby condenser with a nice slow-motion dial and leave a plain dial on the ·0001. The latter can then be set at the bottom of the band and the searching done on the little fellow.

An Earth is Always in Use.

To your other query—do I think metal chassis preferable to wood-and-ebonite, even when no earth is used—the answer is definitely *yes*. After all, you can't help using an earth on short-wave receivers, even if you leave the actual metallic connection out!

J. B. M. (Glasgow) reports a Swedish station, apparently Stockholm, on 39 or 40 metres. W. G. M (Southampton) sends in a long and newsy letter ending with a complaint about a nearby D.C. motor. I recommend him to try a "doublet." From his log of DX amateurs, though, one wouldn't know that there was much wrong!

R. H. R. (Llanrwst) wants the whole truth about my reception in that part of the world when I had a portable up there two years ago. F. N. B. (Hale), whom I met up there, will back me up when I say that it appears to be a perfect locality for short-wave work.

ROUND the RECORDS

Selections and recommendations from the latest gramophone lists

By K. D. ROGERS.

ANOTHER pot-pourri of film-star voices has been published, this time by Regal Zonophone in "The Voices of the Stars." As in the case of the Decca, reviewed recently, the proceeds of the sale of the record is to be devoted to the Cinematograph Trade Benevolent Fund.

Four gramophone companies have co-operated in a big "disc" drive in aid of this fund, and the Regal Zono record is the latest to be released. The voices are, of course, taken direct from the various films in which the stars are appearing. So we have George Arliss delivering part of one of his speeches in *Voltaire*, Diana Wynyard recites the final peroration from *Cavalcade*, and Marie Dressler and Jean Harlow give vent to the final satire in the film *Dinner at Eight*.

In addition to the above named we have an assortment of songs, wisecracks and general remarks from Janet Gaynor, Laurel and Hardy, Katharine Hepburn, Norma Shearer, Charles Laughton (Henry VIII), Leslie Henson, Jack Buchanan, Jack Hulbert, Cicely Courtneidge, Gracie Fields, Evelyn Laye, Mae West, Wallace Beery, Jackie Cooper and several others.

It is a record packed with typical sayings and is a very good souvenir of many of the world's leading film stars. At 1s. 6d. it should successfully swell the coffers of the fund, and it is expected that at least 500,000 will be sold within a week of the release of the record. Don't forget your copy.

How a Dance "Hit" is Made.

I am interestingly watching the building up of a "hit." I am convinced that, in ninety-nine cases out of a hundred, a hit is *made*, not *born*. Repetition, plugging if you like, has its desired effect in stimulating interest in a number—always provided the number is good and has some claim to be plugged—and the result is that people like it, they hum and whistle it, they buy the gramophone record—it is a *hit*.

Did You Ever See a Dream Walking? was well plugged till it became a hit—never would it have attained such eminence otherwise, nor would most of the other modern numbers. Not because they are poor, but because so many are good. The level of dance composition from the melody or character point of view, is exceedingly high. Consequently if no items were starred, they would all remain *en masse*, with few outstanding numbers, and therefore few outstanding record sales.

Thus it is necessary, from a business point of view, to *make* a hit. Occasionally the choice of the future "star" is faulty—the public psychology is misjudged and the hoped-for acclaim is not forthcoming. But usually the hit grows apparently naturally—carefully fostered by a knowing publisher—until every dance band is playing it, crooners are burbling its melody, wondrously out of tune, and the gramophone companies are busily pressing records of it.

The latest ewe lamb of the music-publishing world is "Play to me, Gipsy," which is being groomed for stardom. Gradually more and more of it is heard from dance bands on the air, and the recording companies are busy making discs with its plaintive melody on board.

The number is good, and is a change from the rhythms we have had starred lately—"Play to me, Gipsy" is sometimes a tango and sometimes a foxtrot. Probably the powers that be will succeed in building another success, to last some two months or so till another has to be launched.

Decca alone have recorded the latest arrival at least four times—by Roy Fox, Frank Titterton, Don Sesta's Accordion Band and Alfredo Campoli. There's variety for you! Roy Fox and his Band need no introduction, Frank Titterton's tenor voice is accompanied by Fred Hartley and his Novelty Quintet, Don Sesta has collected a group of first-class accordion players, and Alfredo Campoli is a violinist who is rapidly establishing himself. I specially recommend the Roy Fox and Campoli versions.

Out-of-Tune Tunefulness.

I wonder if there is anyone who can sing so delightfully out of tune as Elsie Carlisle. This is not a criticism, but a commendation. "Straight" singers must shudder when they hear her, but none could honestly deny that, judged apart from a purely musical standard, Elsie Carlisle is a great artiste. She has many copyists, too, which itself is a sure sign of success, though none has yet given me the same pleasure as Ambrose's famous lady crooner.

Her latest exposition of out-of-tune tunefulness is "This Little Piggy Went to Market," and with it, on Decca, is "Gosh, I Must be Falling in Love!" Both are in the best Carlisle style and are exquisite pieces of artistry. By all of which you will gather that I am something of an Elsie Carlisle "fan." When she sings like she does on Decca F3887 I am.

Harlem has come to London in the persons of Cab Calloway and his Orchestra, which have been booked for the Kit-Cat and the Palladium. I have just been listening to a Brunswick recording by Cab and Co. of "Dinah," that immortal Harlem classic which keeps on popping up on the gramophone lists. Naturally, Cab Calloway and his boys do it more than justice. With "Beale Street Mama" it is played in the best Cab style. (01688.)

Guy Lombardo does not show up so well on his Decca records as he did some time ago on another make. His band seems to be coarser and rougher, and I should like to see him get better technical assistance. The Royal Canadians are an excellent combination and have a style and finish that are recognisable the moment they begin to play. This month they have recorded "Time to Go" and "Inka Dinka Doo." The latter has particularly intriguing piano interludes, and the piano backgrounds and breaks of Lombardo arrangements are always worth hearing.

Some Appetite Whetters.

As we go to press H.M.V. and Columbia releases arrive—vast selections of the latest recordings of classical and dance music, ballad and humour. These records I shall have to leave till next time, with the exception of two or three appetite whetters. Here's the first:

Richard Crooks, church soloist at age of nine, joint star performer before 15,000 people at twelve, sings "Smilin' Through" and "My Song Goes Round the World" on H.M.V. DA1360. Whether or not you have seen the Norma Shearer film of the former name you will enjoy its plaintive Irish sweetness. The second item also is perfectly rendered by the famous tenor.

"In Town To-night," played on Columbia and H.M.V. by Henry Hall and Ray Noble Orchestras respectively, features the popular *Knightsbridge* movement from Eric Coates' *London Suite* used by the B.B.C. for their weekly Saturday feature. Ray Noble does not do himself justice—he makes the whole number too monotonous; it is played in strict dance tempo without much originality in orchestration to help it out.

But more of these late arrivals next time; there is plenty of variety among them.

TELEVISION
ALL-ELECTRIC SCANNING

by G. P. KENDALL B.Sc.

THE ADVANTAGES

Almost any number of pictures can be handled, and any number of lines, because the control of a cathode-ray tube is completely electrical. There is no inertia to overcome and no tricky speed control to bother about, the movements of the spot of light being merely a matter of the circuit values. Although beautifully efficient, the operation is fundamentally simple, as Mr. Kendall clearly shows in this account.

IN the early days of radio quite a number of attempts were made to use sundry mechanical relay devices for the purpose of amplifying the signals. In all these the idea was to cause the tiny currents set up by the incoming signals to control a much more powerful local current, but for the most part they were not very successful.

The trouble really was that mechanical devices could not deal efficiently with the high *frequencies* involved. Effective amplification became possible only with the coming of the valve, because here was a relay device in which there were no mechanical moving parts to limit the speed at which it could respond.

There is No Speed Limit.

The place of the moving parts of the old relay was taken in the valve by a stream of electrons and some static charges, and since these are things which have no mechanical inertia effects they can be made to operate at any speed you please.

Now, there is a rather similar position in television at the present time. We have a problem which is not unlike that of the early radio experimenters, in that we want to produce certain effects with currents of rather high frequency, and we are having a certain amount of trouble with mechanical devices

Our exact object, of course, is not in this case to *amplify* the television signals, for we can solve that part of the problem with valves in the usual way, but rather to make them produce the effects we require in the beam of light in the viewer.

First, we want them to produce what I have previously called "light control"; that is, they must vary the *strength* of the beam. Secondly, they have to govern the speed of the scanning process and keep it in step.

In the first case mechanical methods have already been given up as hopeless, and purely electrical methods of light modulation are now used almost exclusively.

Will They be Displaced?

In the matter of scanning, however, mechanical devices are still largely used, and it is interesting to wonder whether we shall not see these also displaced by purely electrical systems before long.

It so happens that there *is* a device which is capable of doing for the scanning process pretty much what the valve did for radio. This device is purely electrical in its working and has no mechanical moving parts whatever, their place being taken by an electron stream and sundry static charges, very much as in the valve.

Nevertheless, it is capable of making a spot of light scan a screen, and by its very nature it has many advantages to offer. It is able to produce scanning of practically any number of lines and any number of pictures per second, and every phase of its operation is under the most complete electrical control.

The name of this wonderful device is, as the reader has probably guessed by now, the cathode-ray tube. Whether it will or will not replace the mechanical systems of scanning I should not like to try to predict, but it certainly has some very weighty advantages.

If I allowed myself to think of nothing but its attractions I should undoubtedly commit myself to the prophecy that it would become the universal scanning method quite soon, but, unfortunately, the matter is not quite so simple as that.

Unlike the valve, the cathode-ray tube has some definite drawbacks when compared with the mechanical methods, these being chiefly a matter of limited illumination and picture size. A minor weakness is the slightly unnatural colour usually given to the picture.

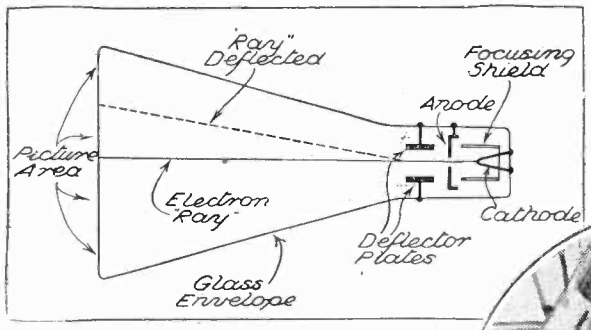
These defects, although they are at present difficult to remove, are not actually inherent in the cathode-ray system, and so it is reasonable to hope that they may one day be eliminated. When that is done there is little doubt in my mind that the cathode-ray system will provide a very nearly perfect receiving system.

So far as present conditions are concerned it can be taken that a picture space of some three or four inches square is the limit of size of the cathode-ray tube of moderate cost. As regards illumination, it is quite good within these limits, but there is not enough light to permit anything in the nature of a projection method to be used. (This rather cryptic remark will be understood more clearly when we begin to study the actual functioning of the cathode-ray tube.)

Complete in Itself.

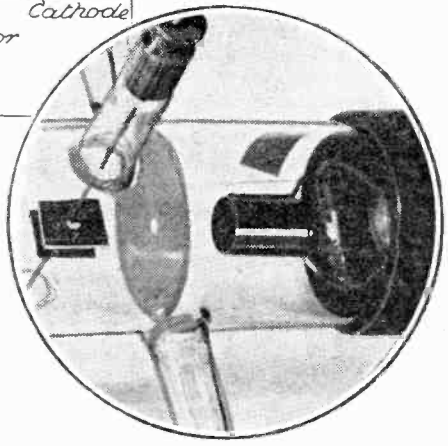
The working of the tube is rather a large subject, and I am not going to try to cover it in detail this week. I think the reader will find it very much easier to get, first of all, a clear idea of the general outline of the subject, and then go into detail later.

The first point which we must realise is that the cathode-ray tube forms practically a complete television in itself, for it does its own light control, its own scanning and even includes the necessary screen on which the picture appears.



HOW THE SPOT IS SHIFTED.

The sketch shows how electrons from the cathode pass in a ray through the hole in the anode and strike the end of the cathode-ray tube, where they produce a spot of light. If a voltage is placed across the deflector plates the ray is deflected, and thus the spot can be moved electrically, and without the aid of mechanics.
A close-up of some of the actual electrodes is shown to the right, the hole in the anode being clearly visible.



The basic principle of the tube is comparatively simple. Our knowledge of valves tells us that a heated filament will give off showers of electrons, and also that those electrons can be influenced by the attraction and repulsion of positive and negative charges in their neighbourhood.

It is upon just these simple facts that the working of the cathode-ray tube is based. The tube contains a filament which emits the desired supply of electrons, and there is a positively charged anode which draws them away in a fast-moving stream.

(*Continued on page* 26.)

"TELEVISING" SPEECH

by J. C. JEVONS

Did you know of the latest scheme for making more room in the ether for television transmissions? It consists of turning the sound accompaniment into light impulses, so that no separate channel is needed for them, and the ingenious method by which this is done is described below.

IN principle there is a certain similarity between transmitting light and transmitting sound, the photo-electric cell in television taking the place of the microphone in broadcasting.

Unfortunately, however, there is a very considerable difference in practice, the problem of television being enormously complicated by the necessity for keeping the picture signals related in space as well as in time. In addition, a much larger band of frequencies is required to transmit a clearly defined picture than to cope with the most elaborate orchestra.

Solving a Troublesome Problem.

At first sight, therefore, the idea of applying the methods of television to the comparatively simple problem of broadcasting sound would seem to be the height of absurdity. Why, it may be asked, should one deliberately adopt a complicated procedure when a far simpler one is already available?

The answer is that it offers one possible solution to the very troublesome problem of finding room in the ether for a combined programme of television and sound.

In a recent number of POPULAR WIRELESS (March 3rd, 1934) a description was given of a scheme for radiating television signals without the use either of a carrier or sidebands. This is the invention of Mr. G. W. Walton, and utilises his well-known system of "Scophony" scanning.

Mr. Walton has now gone a step farther, and proposes to combine a speech programme with his "non-spreading" system of television.

To do so it is necessary to convert the speech signals first of all into "visible" form, i.e. to put them on "all fours" with the pictures to be televised. Once in this form, both the speech and picture signals can be handled by the same photo-electric cell and radiated by the same type of "non-spreading" wave.

Sideband "Spread" Eliminated.

The broad idea of converting sounds into corresponding "light" effects is not particularly novel in itself. It is done, for instance, in talkie film production, where the vibrations of the voice are made to control a "light" valve so as to mark out a visible track, which is afterwards reproduced by means of a photo-electric cell.

Mr. Walton, however, employs a very different arrangement from this for transforming speech into an equivalent light signal. In addition he wipes out the ordinary differences of frequency (which determine the pitch of a note) and converts them into differences of *position* in space.

At the receiving end the new "spacing" is, of course, converted back into the original sound frequencies, but meanwhile he has managed to get rid of those frequency differences which produce sidebands. In other words, transmission through the ether can now take place without sideband "spread."

The first step in the change-over from sound into light consists in applying the microphone current to a pair of electrodes which have already been charged up to a point just short of that at which a spark will pass. The addition of the microphone voltage "does the trick" and produces a spark. Actually each individual voice frequency produces its own spark, so that the result is a "band of light."

In order to secure the spacing effect already mentioned, advantage is taken of the fact that, as the voltage builds up, each spark prefers to discharge itself at that particular point at which the circuit "behind it" is in resonance with the applied frequency.

This will be made clearer by reference to Fig. 1, which shows two rods or electrodes A, B placed in close proximity to a long coil C, which is charged up by the battery H.T. to a voltage just below that at which it would normally spark across to the rods. The electrodes and coil are, in practice, enclosed in an evacuated valve so as to reduce the required voltage to a comparatively low value.

Resonant Discharge Oscillations.

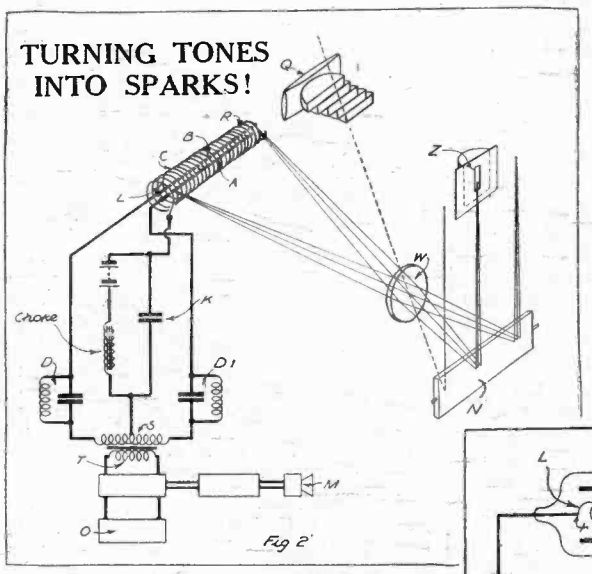
The output from the microphone transformer is now applied across the transformer T to the two rods, as shown, and serves to increase the voltage on one or the other until a spark results.

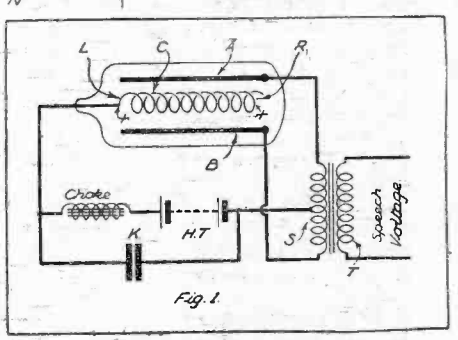
For a low-frequency note the spark will pass at the open end of the coil marked R, because the resulting discharge oscillations will then be in resonance with the circuit containing the whole of the inductance of the coil C, together with the by-pass condenser K and one half of the transformer winding S.

For a high-frequency note the discharge occurs at the near end L of the coil, because the resulting discharge does not then have to pass through the windings of C, but goes direct through the condenser K and the half of the transformer windings S. In other words, a low-frequency note takes a path containing more inductance (i.e. more turns of the coil C) than a high-frequency note.

For other frequencies the discharge occurs at some intermediate point along the coil, such that the circuit opened up to the discharge is "in tune" with the particular frequency in question. In this way a complex of speech frequencies is converted into a band of light.

In the combined scanning system shown in Fig. 2 the current from the microphone M is first modulated on to a local carrier-wave O before being applied to the transformer T, and the circuits D and D1 are tuned to the upper and lower sidebands. No sideband frequency is actually radiated. The band of light, when produced, is thrown by a lens W on to a vibrating mirror N, together with the picture elements produced separately by the "Scophony" scanner marked Q. The combined picture and voice signals are then swept by the mirror N across the face of a photo-electric cell Z, and the resulting currents, are applied to the transmitting aerial.





SOUND CREATES A BAND OF LIGHT.

When the microphone (M, Fig. 2) is spoken into, corresponding voltages appear across the transformer (T), causing sparks to occur along the large coil, C, at points depending upon the frequencies. The resulting band of light is passed through the lens W, and transmitted as explained. Fig. 1 shows the coil, etc., in greater detail.

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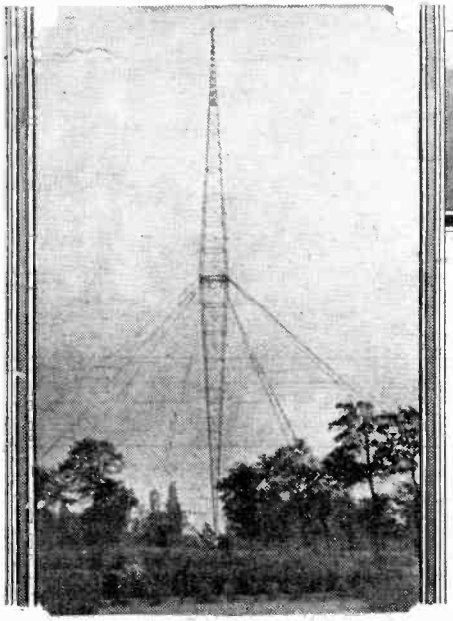


1,000 FEET UP

—RADIO BUDAPEST BUILDS A NEW MAST

The new Budapest radio station boasts the tallest aerial mast in the world—which is also the highest structure in Europe. But its claim to fame is based on more than a very remarkable engineering feat, as this description of a visit to the new transmitter shows.

By A. A. GULLILAND.

IT is perhaps not quite correct to call an aerial mast a "cigar." But in the case of Radio Budapest's new mast there are points which force one to a comparison. If you place a lighted cigar vertically on the table and hold it a cloud of smoke will very shortly surround its upper end. At Budapest clouds do the same to the mast. Then, again, a cigar of the torpedo type is thin at the bottom, thick in the centre and thin at the top.

Some Handful!

Budapest's new aerial mast rests on a surface of 160 square centimetres, about the size of a man's hand. It widens out at the centre, where it measures a little over 14 metres across, and it thins down again to a circular hole 30 cm. in diameter. The mast is 284 metres high, and to this must be added the projecting length of the telescopic steel pole at the top of the mast. This brings the height up to 314 metres, or about 1,030 feet.

Budapest's radio mast is the world's highest aerial—the highest structure in Europe and the third highest structure in the world. Seven hundred metres of feeder-line connect the mast to the transmitting station, situated in a new wing of Budapest's present transmitter house.

Built by Standard Telephones & Cables, of London, at their Hungarian works in Budapest, the new 120-kw. transmitter is one of the very few stations in Europe which, under special international agreement, are allowed to operate on more than the international limit of 100 kw. The station, which commenced testing about the middle of November, has already proved to be one of Europe's "big noises."

British Built.

Before going into some of the special features which make the new Radio Budapest one of the most interesting transmitters in Europe I would like to draw attention to the fact that this wonderful aerial mast was constructed by a British firm, and that work, with Hungarian labour and material, was carried out under the supervision of a British engineer—a Scot, by the way. In 1893 a Hungarian engineer discovered broadcasting (at that time it was still over a system of wires). Ever since, the Hungarian Broadcasting Company has always found the necessary courage for some pioneer experiment. They have it now in the aerial mast; they also have it in the 120-kw. transmitter.

Everything in Duplicate.

Driving the 18 km. out from Budapest to Lakihegy (which means "great hill"—in reality there is only a small mound which warrants the name!), we were challenged on arrival by a fine-looking Hungarian soldier, complete with rifle, bayonet and cock's feathers on his hat. After a short parley we were allowed to pass and were taken to one of the Standard Company's engineers who was in charge of the building operations.

One remark of his seemed to recur at every moment. At first I thought it was his favourite catchword; later on I found that it actually was the case. "One hundred per cent spare," were his words. Yes, the new Radio Budapest has a "100-per-cent spare part" at every turn.

After passing the guard we entered the central part of the transmitter building which contains the offices. To the right there is the old German 18·5-kw. transmitter, built in the "open" style. To the left is the new 120-kw. British apparatus, well protected from human hands as long as it is under power. This is achieved by the famous interlock system which my guide spoke about.

NO TRESPASSERS!

The Budapest station buildings at Lakihegy are permanently guarded by Hungarian troops in their picturesque uniforms. Visitors are subject to a close examination before being allowed to enter.

Prevents Wavelength Wobbling.

One first enters a room containing the metal rectifiers for the grid circuits, etc., and a hot cathode mercury vapour rectifier producing 22,000 volts for the anodes of the last-stage valves. Then you come to the large transmitter hall. On the left there is the speech output panel, followed by the oscillator stages.

Crystal control is provided, in conjunction with a thermostat to prevent temperature variations. Should a breakdown occur there is a second crystal to switch in, and should the whole circuit fail (which is extremely improbable) there is another circuit which can run the transmitter for a few hours at least.

Leaving the oscillator and modulator stages, one enters what resembles a low-lying hut. A passage goes down the centre. On one side you have the "push" and on the other the "pull" of the last two stages. In the case of a valve breaking down a turn at a single wheel and all high-tension current and cooling water are switched over to the "100-per-cent spare" valve built in alongside.

Seeing How it Works.

The control desk with four buttons for setting the transmitter in motion, stands facing the front wall of the "hut." The desk is fitted with a cathode-ray oscillograph, so that the engineer can actually see the modulation of the transmitter.

The water pumps for the elaborate cooling system are in the cellar immediately below the transmitter.

The porcelain tubes containing the anode cooling water are also there. These porcelain "coils" now take the place of the rubber used in "the olden days." (Lorenz, the inventor, first used this type of cooling spiral at the Leipzig station.)

Budapest is not only a tip-top station in the sense that it embodies the latest developments, but its position on the medium-wave tuning dial is also right at the top. The actual wavelength is 549·5 metres.

And now may you have good reception of the station which British brains and Hungarian brawn have made to carry the call "Itt Radio Budapest" into space!

PERSONALITIES AND PECULIARITIES AT THE BIG HOUSE

By OUR SPECIAL INVESTIGATOR

who brings up to date the human scene behind the walls of Broadcasting House, and explains how the reorganisation of 1933 has had its effect upon the principal exponents of broadcast entertainment.

THE B.B.C. is staffed by young men, and consequently there are fewer changes than in comparable organisations. There are, however, internal rearrangements which involve a kind of "ebb and flow" in the popularity, prestige and importance of the principal officials. It is, therefore, of interest to bring up to date the human scene behind the façade of Broadcasting House.

Of course, the reorganisation of 1933 was expected to make important changes in various directions. Not all these expectations have been fulfilled. First of all, Mr. Whitley, the Chairman, is much more actively engaged in the general scheme of broadcasting than he was this time last year. Mr. Whitley has an office to himself, and this he occupies with a regularity which would do credit to most heads of businesses.

The Chairman, in addition to keeping an eye on policy matters, takes a direct personal interest in the Empire Service and in the Talks. His training as Speaker in the House of Commons makes him useful in pouring oil on troubled waters, both inside and outside "The Big House." Among the other Governors the influence of Mrs. Agnes Hamilton is perhaps the most evident. Mrs. Hamilton's active mind plays on a great many of the problems of broadcasting.

Sir John Reith, as Director-General, continues to focus on himself the direction of the whole of the activities of the B.B.C. Since the reorganisation last year he is freer from details of the business and deals directly with only two or three people instead of with about two dozen.

One result of this new freedom is that Sir John is able to attend more diligently to his social duties, and his name now appears more frequently in the published lists of those present at social gatherings. Apart from his duties in broadcasting and his new social responsibilities, Sir John is making a close study of modern organisation, commercial and public, possibly with a view to overhauling some industry or public utility when he tires of the B.B.C.

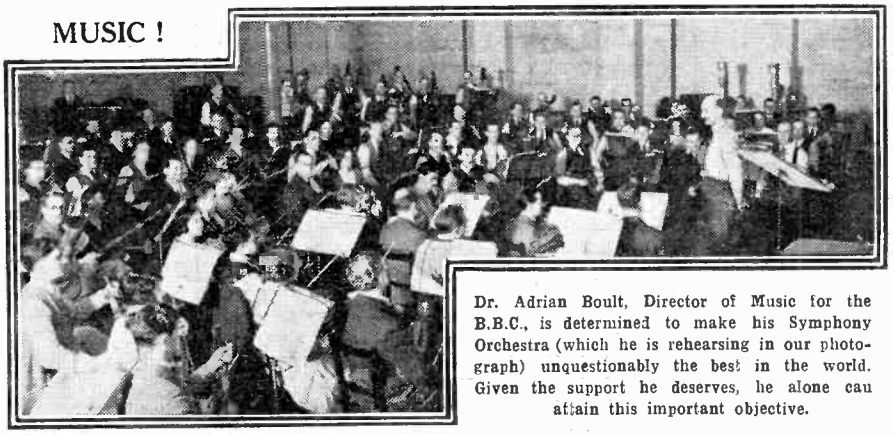
Sir Charles Carpendale.

As the hour for his retirement draws nearer Sir Charles Carpendale naturally disengages himself from some of the burdens of administration. But he still carries a heavy responsibility as President of the International Union of Broadcasting, the duties of which take him across the Channel with increasing frequency and for longer periods of anxious deliberation.

In Charge of Programmes.

Colonel Alan Dawnay, at the head of Programmes, is making his presence felt. He is liked personally. He pays special attention to the political aspects of Talks, and his influence is reflected in the greater care which is being taken to avoid expressions of extreme views. Colonel Dawnay shares with Admiral Carpendale great keenness for outdoor sports.

MUSIC !



Dr. Adrian Boult, Director of Music for the B.B.C., is determined to make his Symphony Orchestra (which he is rehearsing in our photograph) unquestionably the best in the world. Given the support he deserves, he alone can attain this important objective.

Mr. Gladstone Murray, still in charge of Public Relations in all their aspects, finds his position strengthened by the new organisation. Both as framer and interpreter of B.B.C. policy his position is pivotal, although internal complacency and outside jealousy make it unusually difficult. Mr. Murray's good will, however, is firmly established in the friendship which he has attracted in a remarkable area comprising the extremes of Fleet Street and of politics.

Mr. Eric Maschwitz, alias Holt Marvell, is the programme personality who has made most headway in the past year. His versatility and insatiable appetite for work, combined with rare originality, have already made him the "Noel Coward of Broadcasting." To him goes the credit for the great improvement in light entertainments and vaudeville. The cinema industry has its eyes on Mr. Maschwitz, and it is to be hoped that the B.B.C. will not let him go easily.

Mr. Val Gielgud, head of Dramatic Production, continues to share with his friend Mr. Maschwitz the "programme honours." They are, incidentally, joint authors of the book "Murder at Broadcasting House," which is a current "best seller." Mr. Gielgud thinks in terms of romantic drama, and he, too, imposes his personality increasingly on the products of the microphone.

Dr. Adrian Boult gains ground as Music Director. He is determined to make the B.B.C Symphony Orchestra unquestionably the best in the world, and, given the support and resources he deserves, he alone can attain this important objective. Dr. Boult is a non-smoker and a total abstainer; he feeds and sleeps scientifically, all to the end of general efficiency; and he manages this without submerging any of the qualities of sympathy and humanity that endear him to all with whom he comes in contact.

Mr. Noel Ashbridge, the Chief Engineer, continues unobtrusively to keep the B.B.C. ahead of all other broadcasting concerns on the technical side. The opening in July of the transferred Daventry at Droitwich will be an occasion of triumph for Mr. Ashbridge. Although he was concerned in carrying out the Regional Scheme, the origination of the idea and most of the planning had been contrived by his predecessor, Mr. P. P. Eckersley. But Droitwich, and the new stations in the north-east of England, the Highlands of Scotland and in Ulster are Mr. Ashbridge's particular jobs.

Entertainment Balance.

Mr. Ashbridge has very definite ideas about programmes and programme building, and it would be better for the service provided by the B.B.C. if more attention were paid to his views in matters outside his official province.

A new programme personality is Mr. Lindsay Wellington, who, as Director of Presentation under the new organisation, is responsible for the arrangement and

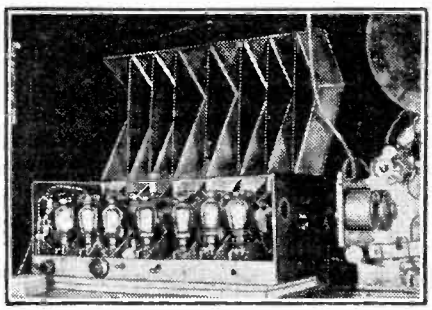
(*Continued on page 25.*)

When the B.B.C. contract with the Baird Company expires at the end of this month, there is likely to be great interest and competition in the world of television. Several firms have, without help from the B.B.C., developed new systems of transmission, and the whole question of the future of "looking-in" is here discussed by our Chief Radio Consultant.

THINGS are moving. You can distinguish their movement quite clearly. The definition is not perfect . . . .

I went to hear a lecture and see a demonstration of a velocity-modulation cathode-ray system. I came away tremendously impressed with the ingenuity of the inventors of the system, but more than ever convinced that my point of view about television is a right one.

A NEW SYSTEM



This picture and the one in the third column show the transmitting apparatus for the new Cossor cathode-ray system of television, successfully demonstrated a few weeks ago.

The velocity-modulation system is very ingenious. The spot of light travelling over the screen dwells longer on the screen when it wants to leave the impression of a white, but moves quickly when it, vice versa, wants to indicate a dark. Moreover, the system has the uncanny prescience to tell itself when it has seen a white or a dark, and to slow itself down or speed itself up automatically.

Velocity Modulation.

Certainly the results achieved are far ahead of anything I have ever seen done by the B.B.C. But then, of course, so long as you try to do television with only a side-band spread of 9 kc., you are bound to have poor results. This is no fault of the B.B.C. engineers. This has been and is true for all time.

The "amplifier" used in the velocity-modulation system had a fairly even response from 50 cycles to 250,000 cycles! The authors obviously realised the absolute necessity to secure an even response over a very wide frequency spread. There is a considerable difference between a spread of 250,000 cycles and one of 10,000 cycles! Even with this big spread the definition, in my opinion, left a great deal to be desired. But that *is* purely a matter of opinion.

Some think that the demonstration showed that television, using such a system, has definite entertainment value. After all, they thought, or said they thought, that about the system now figuring on the B.B.C. broadcasts. They may be right. It simply does not entertain me, however.

All the time it's a question of entertainment value. Is the result worth while? Directly you could broadcast intelligible speech, broadcasting had entertainment value because it was a full-scale experience to listen to people talking. But a shadow show demands, for its enjoyment, real, definite and full-scale content before it can please.

"Far More Serious Problem."

We are, at present, in a position to send from one place to another a somewhat blurred impression of a home movie. Do not think that I am trying to be superior and pretend that I could do much better. The problems are quantitatively so terrific that I am amazed at the ingenious and painstaking way they have been partly successfully tackled. But the entertainment result is not with us as yet—at least, so I feel.

But suppose, at long last, it will, by more and more ingenious and painstaking and inspired effort, come about that, with a million cycles of spread, perhaps, we shall be able to "transmit films" from one room to another. One has then to face the, to me, far more serious problem of being able to broadcast the result.

The only means to do this that I can envisage is via ultra-short waves, because, with carrier-frequencies of tens of millions, side-bands of millions are in sensible proportions. But ultra-short waves are, I suggest, tricky, involve problems with motor-ignition interference, and bring about large frequency discrimination over the necessarily wide spectrum transmitted.

Land-line Difficulties.

Then, again, we are talking of film transmissions. It is another nasty problem to transmit, with any degree of clarity, a running commentary to all and sundry. For instance, we might want to televise the Derby, but how could we connect Liverpool and London? A land line to be non-frequency discriminating over a million cycles? No sir! Not yet, anyway. So, if we would use ultra-short waves, we are limited to the transmission of films from a studio.

Now, the next thing is to ask oneself if one likes films on a home screen. Perhaps the majority do, but a "fan" like myself, educated to the standards of the "talkies," finds even a poorly lighted screen intolerable; and as to a small screen——! But let me not seem to invade these pages with too personal a note; my preferences, likes and dislikes may be unimportant if they are not shared by the majority.

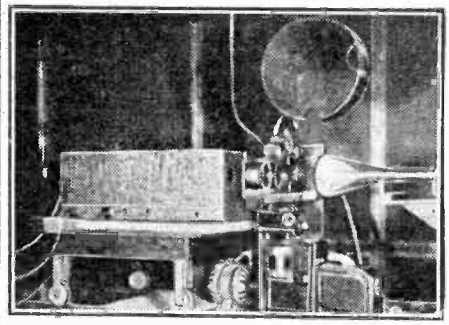
Unbounded Admiration.

In any case, my admiration for the ingenuity of the inventors of modern systems where scanning discs and synchronisation problems have disappeared and where a proper number of lines has been secured knows no bounds.

However, it is essential that we keep our perspective clear. It was always obvious that we should one day get a good picture "from this room into that," provided someone sat long enough over the problem; it still remains to know how to transmit, not from here to there, but from anywhere to everywhere. Even when that's good I may not like it, but, as I say, it remains to be seen if others do.

Incidentally, the B.B.C.'s position is a curious one. They took up one firm's system to aid "its wonderful invention." At least two firms, without any help from the B.B.C., have developed greatly improved systems which cannot be used on the normal wavelengths. So apparently B.B.C. help was not essential.

TRANSMITTING FILMS



The apparatus has been used for televising films, as seen here. The transmitting tube is on the right of the picture.

But presumably they must, having given facilities to one firm, give them to others. Will they build special stations? And, if they do, could I be guaranteed that my receiver will not become useless through obsolescence? And . . . .?

Yes! I think I was right!

But good luck and hearty congratulations to the technicians for the work they have done!

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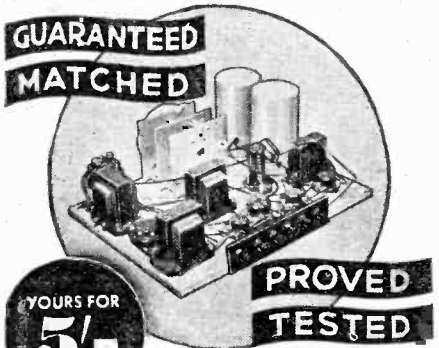

Another **PETO-SCOTT** triumph—this latest Class B Battery 4 Kit at a popular price. Seven times the volume of an ordinary battery set, with outstanding performance equal to "mains" receiver. Kits supplied with detailed "Simple to build" instructions and assembly blue print. Matched and tested components. Guaranteed for 12 months by Peto-Scott. **KIT "A,"** less Valves and Cabinet. Cash or C.O.D. Carriage Paid. **£3/10/0,** or 5/- deposit, balance in **12** monthly payments of **6/-**.

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Recommended **PETO-SCOTT SPEAKER,** if required, add **22/6** to Cash Prices or **2/-** to each monthly payment.

W.B. P.M.6A MICROLODE PERMANENT MAGNET SPEAKER, with switch controlled multi-ratio input transformer. Cash or C.O.D. Carriage Paid. **£1/12/6.** Balance in **8** monthly payments of **4/3.** — Send **2/6** only

BLUE SPOT 99 P.M. PERMANENT MAGNET MOVING-COIL SPEAKER. Complete with tapped Input Transformer. Cash or C.O.D. Carriage Paid. **£2/19/6.** Balance in **10** monthly payments of **6/-.** — Send **6/-** only

NEW ROLA CLASS B PERMANENT MAGNET MOVING-COIL SPEAKER AND AMPLIFIER. Complete with Valve and Input Transformer. Two models: **A** for PM1B, PD220 and 220B; **B** for 240B and HP2 (state which when ordering). Cash or C.O.D. Carriage Paid. **£3/11/0.** Balance in **11** monthly payments of **6/6.** — Send **6/6** only

NEW BLUE SPOT CLASS B OUTPUT STAGE. As advertised. Complete with Osram B21 Class B Valve. Cash or C.O.D. Carriage Paid. **43/6.** Balance in **11** monthly payments of **4/-.** — Send **4/-** only

ATLAS C.A.25 ELIMINATOR for A.C. mains, Class B and Q.P.P. Four tappings: 60/80, 50/90, 120, 150 volts., 25 m.a. Cash or C.O.D. Carriage Paid. **£2/19/6.** Balance in **10** monthly payments of **6/-.** — Send **6/-** only

GARRARD AUTOMATIC RECORD CHANGER for A.C. mains. Mounted on unit plate, complete, ready for fitting in position, including Garrard pick-up and tone arm. Cash Price, **£10/10/0.** Carriage Paid. Balance in **11** monthly payments of **18/6.** — Send **18/6** only

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AVOMINOR TEST METER. Cash or C.O.D. Carriage Paid. **£2/0/0.** Balance in **7** monthly payments of **5/6.** — Send **5/6** only

ANY ITEM SUPPLIED SEPARATELY-

BIFOCAL THREE

KIT "A" Author's Kit of First Specified parts, including Ready-drilled Panel, Baseboard and Westector, but Less Valves and Cabinet. Cash or C.O.D. Carriage Paid. **£5 : 15 : 0**

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KIT "B" As for Kit "A" but with Valves only. Cash or C.O.D. Carriage Paid. **£7:14:0.** Or **12** monthly payments of **14/-**

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KIT-BITS

You pay the Postman. We pay Post Charges on all orders over 10/-. Great Britain Only.

		£	s.	d.
2	**Varley** Bifocal focusing coils	1	1	0
2	**J.B.** .0005-mfd. condensers (Popular Log.)...	15	0	
1	**Ferranti** type A.F.4 L.F. transformer ...	17	6	
1	**Benjamin** "Autocontrola" unit	7	6	
1	**Westinghouse** Westector W.6	7	6	
1	Set of **Specified Valves**	1	19	0

RECOMMENDED PETO-SCOTT *Walnut* CABINET

This handsome walnut polished cabinet is constructed throughout in first quality material and beautifully hand french-polished. Macassar veneers. CASH OR C.O.D. **17/6**

Packing and Carriage 2/6 extra.

SEND FOR 1934 CABINET CATALOGUE.

S.T. 500

KIT "A" Comprising Mr. John Scott-Taggart's Kit of FIRST SPECIFIED Components, including Telsen Class B Output Choke, Peto-Scott "Metaplex" Baseboard and Ready-drilled Panel and Terminal Strip. Less Valves and Cabinet. With FULL-SIZE Blue Print and copy of "Popular Wireless" Oct. 21st. Cash or C.O.D. Carriage Paid. **£5-5-0**

or 12 monthly payments of 9/6

KIT "B" As Kit "A," but including 4 Specified Valves. Cash or C.O.D. Carriage Paid, **£7-10-3**

or12 monthly payments of 13/9.

KIT "CT" As Kit "B," but including Peto-Scott Specified Walnut Table Cabinet. Cash or C.O.D. Carriage Paid, **£8-9-9**

or12 monthly payments of 15/6.

KIT "CC" As Kit "B," including Peto-Scott Specified Walnut Consolette Cabinet. Complete with Baffle Baseboard Assembly, but less Speaker. Cash or C.O.D. Carriage Paid **£8-19-9**

Or 12 monthly payments of 16/3

If Peto-Scott Permanent Magnet Speaker required add 19/6 to Cash Price or add 1/9 to each monthly payment.

FINISHED INSTRUMENTS

"S.T.500," complete in Peto-Scott Walnut Table Cabinet, exact to Mr. John Scott-Taggart's FIRST Specification. Aerial Tested. Complete with Valves.
Cash or C.O.D. Carriage Paid, **£10-0-0**
or 12 *monthly payments of* 18/3.

"S.T.500," complete in Peto-Scott Walnut Consolette Cabinet, exact to specification. With Peto-Scott Moving-Coil Speaker. Complete with Valves. Ready to Play. Aerial Tested.
Cash or C.O.D. Carriage Paid, **£11-5-0**
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ORDERS OVER 10/- SENT C.O.D. CARRIAGE AND POST CHARGES PAID

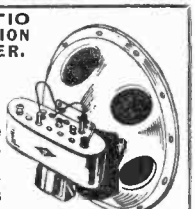
PETO-SCOTT Permanent Magnet MOVING-COIL SPEAKER

Power and Pentode Output. Complete with input transformer. Cash or C.O.D. Carriage Paid, 19/6. Or send only 2/6; balance in 5 monthly payments of 4/-.

2/6 DOWN.

PETO-SCOTT 30 RATIO EXTENSION SPEAKER.

Suitable for 1001 Receivers, including CLASS B, Q.P.P., Super-Power and Pentode outputs. Instantly adjustable ratios. Cash or C.O.D. Carriage Paid, 29/6. Yours for 2/6; balance in 6 monthly payments of 4/9.

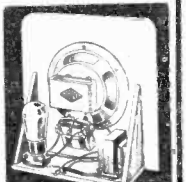


PILOT CLASS B SPEAKER AMPLIFIER KIT

YOURS FOR 5/-

All the Rage

HAVE IT HOME ON 7 DAYS' TRIAL



Complete Kit comprises B.V.A. Class B Valve, Peto-Scott Permanent-Magnet Moving-coil Speaker, Full-size Diagrams and Detailed Assembly Instructions.

Send only 5/-. Balance in **11** monthly payments of 5/-. CASH or C.O.D. (Carriage Paid, £2/15/0.)

Pilot Class B Conversion Kit

Converts your present Battery Set to Class B Amplification. Complete with all necessary components, including driver transformer, Class B output choke, W.B. 7-pin valve holder, B.V.A. 240B valve, wire and screws, etc. Full-size Blue Print, assembly instructions and diagrams. Cash or C.O.D., 37/6. Balance in **7** only monthly payments of 5/6. — Send **5/-**

PETO-SCOTT CO. LTD., 77, City Road, London, E.C.1. Tel.: Clerkenwell 9406-7
West End Showrooms: 62, High Holborn, London, W.C.1. Tel.: Holborn 3248.

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for which I enclose £.....s.....d.
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RADIO STEP-BY-STEP

Our SPECIAL SUPPLEMENT FOR BEGINNERS

RADIO TERMS

by G.V. DOWDING ASSOCIATE I.E.E.

A Practical Survey covering every Phase of Wireless.

MAGNETIC FIELD.

THE field of magnetic influence set up around a magnet or a conductor through which current is passing.

MAINS UNIT.

The D.C. type of mains unit comprises smoothing circuits for eliminating irregularities and series resistances or a potentiometer (generally styled potential divider) for regulating the outputs.

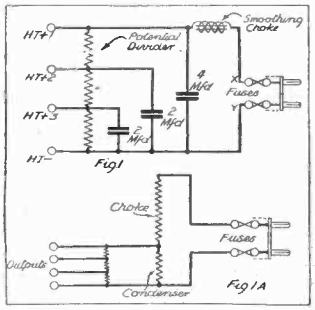
In the case of A.C. mains rectification is necessary, and this is carried out either by a valve or a metal rectifier. In addition to a rectified and smoothed output for H.T. purposes some A.C. mains units embody low-voltage outputs of "raw" A.C. for the heaters of A.C. valves.

Fig. 1 shows the theoretical circuit of a typical mains unit for D.C. mains. The main smoothing is accomplished by the choke and the 4-mfd. fixed condenser. The choke offers a high resistance to current fluctuations, while that of the fixed condenser is comparatively low.

Reducing Hum.

These two components constitute a potentiometer arrangement in so far as current irregularities are concerned, and the idea is theoretically expressed at Fig. 1a. It will be observed that the output of the unit is tapped across only a small part of this "potentiometer," and therefore only a small proportion of the "hum" irregularities are taken off. The larger the inductance of the choke and the greater the capacity of the condenser the smaller it will be.

SMOOTHING CIRCUITS



This diagram illustrates the way the smoothing circuits of mains units work.

This potentiometer arrangement applies only to voltage fluctuations; the condenser plays no part in the regulation of the smoothed output voltages.

This is done by the potential divider. The maximum voltage exists across the H.T.+1 and H.T.− terminals, while the voltage across H.T.+2 and the negative point and this and H.T.+3 will be decided by the positions of the "taps."

The 2-mfd. fixed condensers are for purposes of "decoupling." Portions of the potential divider (which is merely a resistance) will be common to the anode circuits of various of the valves in the set with which the unit is used.

This would create undesired coupling effects and result in howling and motor-boating if decoupling steps were not taken. The condensers decouple to a considerable extent by lowering the impedance of the potential divider.

But additional decoupling by means of series resistances and by-pass condensers in the set itself is often necessary.

The current that an H.T. unit will pass to a set is limited by its smoothing components and by its potential divider, or series-voltage dropping resistances if these are used.

Current Limitations.

In the simple D.C. unit (Fig. 1) the D.C. resistance of the smoothing choke offers some resistance in the H.T. +1 output, but there is a further practical limit to the useful current that can be taken from this point, and that is fixed by the current-carrying capacity of the choke.

If the current exceeds a certain value either the windings might not be able to carry it or, more usually, the inductance of the component might drop considerably and its smoothing effect depreciate.

Obviously, the current limits of the other two outputs will be additionally limited by the potential divider.

It is always advisable to work a mains unit well inside its rating.

When a particularly sensitive set is being used it is frequently necessary to apply additional smoothing if it is desired to eliminate hum entirely. This can be added externally to a mains unit. A smoothing choke in series with the "tapping" to be smoothed (the one serving the detector is commonly the one needing such treatment) and a 4-mfd. fixed condenser joined between the set side of the choke and H.T. minus are all that are necessary. It is essential that a D.C. mains unit should be connected to the mains a certain way round, but it does not matter which way the mains-connecting plug of an A.C. unit is inserted in the power or light point.

An A.C. unit is similar in its smoothing and voltage-distribution principles to a D.C. unit, and the Fig. 1 circuit can be transformed into an A.C. mains unit circuit by the addition of the rectifying circuit shown at Fig. 2, this being joined to Fig. 1 at the points marked X and Y.

This arrangement shows a valve rectifier operating on the half-wave principle.

When an A.C. unit is used an ordinary earth connection to the set is permissible, but this is not so with a D.C. unit. One or other of the mains will be earthed, and should it be the positive one a direct short circuit occurs with a direct earth connection to the set.

Often the set will work quite well with a D.C. unit without the usual earth connection, but in the event of one being employed a series fixed condenser of, say, 2-mfd. capacity, with a working voltage in excess of the voltage of the mains, must be introduced.

A mains unit for a Class B or Q.P.P. set needs to be able to cope with widely fluctuating conditions of load. That is to say, its outputs should retain a reasonable evenness of voltage at considerably different current outputs.

The Neon Stabiliser.

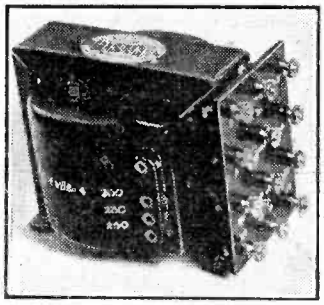
The ideal method of ensuring this is to employ a neon-tube stabiliser.

All mains units should embody fuses, and it is also desirable that they should be totally enclosed within metal casings.

Their outputs cannot be checked accurately with an ordinary moving-iron voltmeter of the usual average resistance type, owing to the fact that such an instrument will itself draw current and thus provide misleading readings.

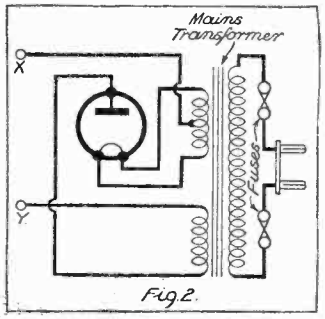
In the absence of a high-resistance voltmeter the outputs can be checked with a milliampere, this giving indication as to whether or not the tapping being tested is providing the correct current for the conditions.

FOR POWER WORK



Multi-winding transformers similar to this Ferranti component are used to give the various outputs needed in a comprehensive mains unit.

A.C. TO D.C.



The addition of a unit of this type will convert a D.C. mains unit for use on A.C.

THERE'S A DARIO VALVE FOR EVERY NEED AND THEIR PRICE MAY SAVE YOU POUNDS

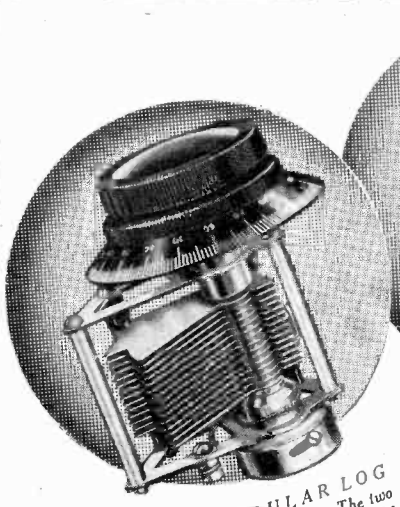
● A full range of battery valves for 2-volts and 4-volts. A complete series of mains valves including H.F. pentodes, Diode-tetrodes, and D.C. valves with 20v. heaters. On one and all you'll save shillings.

Why! In equipping a 5-valve mains set with DARIO, you'd be something like £1.10.0 in pocket—and the saving wouldn't mean the slightest sacrifice in performance. The full DARIO range covers more than 39 efficient, up-to-the-minute valves for every position in any set.

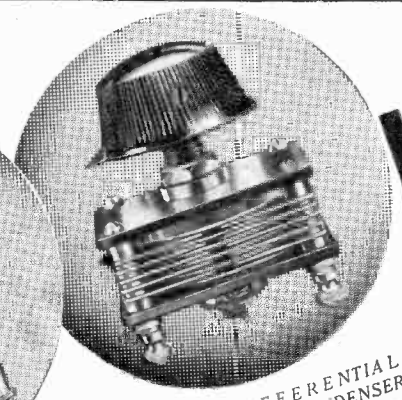
Send for a list of popular types and a table showing DARIO alternatives for the leading standard valves.

DARIO VALVES

IMPEX ELECTRICAL LTD., 47, VICTORIA STREET, WESTMINSTER, LONDON, S.W.1



J.B. POPULAR LOG SLOW MOTION. The two Popular Logs are fitted with J.B. "D" type Slow Motion mechanism. The price complete with 3-inch dial and knob, is 7/6



J.B. DIFFERENTIAL REACTION CONDENSER has bakelite dielectric between vanes, which makes short circuit at normal voltage impossible. The price complete is 4/6

Essential for the P.W.

BIFOCAL THREE

Designed by nine of the leading component manufacturers—Therein lies the success of the Bifocal Three—Every component used is therefore the best of its kind. J.B. is universally acknowledged to mean complete efficiency and advanced design in J.B.'s special field. The J.B. Popular Logs and Differential Reaction Condenser for instance.

PRECISION INSTRUMENTS

REG. TRADE MARK

Advertisement of Jackson Bros. (London) Ltd., 72, St. Thomas' Street, London, S.E.1.

TESTED AND FOUND-!

Being Leaves from the Technical Editor's Notebook

NEW BULGIN TERMINALS

HAVE you ever noticed how much time you sometimes spend doing something that is supposed to occupy "only a few minutes"? On such occasions one wonders whether it is personal incompetence or an unfair number of minutes compressed into that qualifying "few"!

Take, for instance, the hooking up of a new set. No one begrudges a whole evening or even two evenings on its building. But how long does it take to connect up the batteries, aerial and earth and to get the instrument ready for the first test?

After years and years of set construction I still find myself leaving "only a few minutes" for the job! It still seems a job that ought not to take more than a few minutes. And yet frequently it does take many more minutes than ought honestly to be described as a "few."

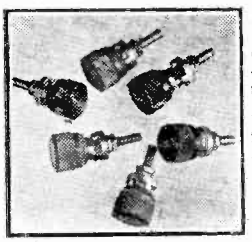
I think that quite often the terminals are largely to blame. Leads of correct length must, of course, be prepared, but how seldom they can be hooked on to the terminals "in a jiffy"!

But A. F. Bulgin & Co., Ltd., of Abbey Road, Barking, Essex, have produced a new-type terminal which definitely does expedite connections and, moreover, ensures that the connections are good when made.

It has what is styled a "battlemented base." This replaces the more usual smooth metal base on to which the terminal head screws in order to clamp the wire down.

Often the area of these bases is small because of generous bevelling, and unless loops are made in the lead ends they are squeezed out and the head fails to clamp them. Especially is this the case when the wire happens to be stout in gauge or there are several wires to go to the one terminal.

The Bulgin "battlementing" prevents all this, and the leads simply cannot stray away as the head is tightened.



The speed with which wires can be connected to these Bulgin terminals is nearly as big a point in their favour as the excellence of the contact when made. The price is 3½d.

The new terminals have nicely moulded bakelite knobs or heads which are excellently engraved in all the usual indications.

But—and this is the second great feature of the device—the head cannot accidentally come off. Therefore you can't be landed with two or more detached heads, wondering vainly which came off which of the terminals!

Nevertheless, the heads can be taken off quite easily with the fingers should it be desired to use ring tags or wire loops.

I consider this a valuable practical development, and one that alone would make the new Bulgin terminal one of the outstanding products of this season.

Now I must give you the catalogue details. The terminal is listed as the New Type T.L., and the retail price is 3½d.

GOLTONE FIVE-WAY CABLES

When a mains set employs a separate "power pack," the question of connecting leads assumes some considerable importance. It is neither tidy nor, perhaps, safe to employ separate wires. At least, I always hold the view that the fewer leads the better where any kind of mains link is concerned.

However, there are not many radio arrangements for which there are not special expedients these days. And in this case the requirement is very simply met by Messrs. Ward and Goldstone, of Frederick Road, Manchester.

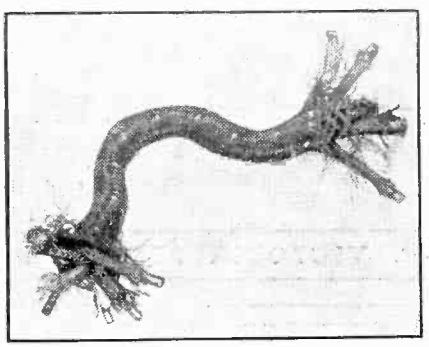
As a matter of fact, it would be astonishing if there were any job for which Messrs. Ward and Goldstone were not able to supply a perfectly suitable wire or cable!

This particular Goltone manufacture is a 5-way cable comprising three leads of 23/36 stranded wire (i.e. twenty-three wires of 36 gauge) and two leads of 70/36.

The latter pair is intended to carry the L.T. for the valve heaters, and it will easily handle six amperes at four volts with negligible voltage drop and with perfect safety.

The individual leads are distinctively coloured, and each is rubber and fabric covered, the whole being bunched by a stout outer woven-fabric covering.

This cable costs 7d. per yard, plus 20% for quantities less than 100 yards.



Two leads in this five-way cable are intended for filament or heater wiring, while the other three may be used for H.T. or grid bias.

Messrs. Ward and Goldstone also make a similar 5-way cable of somewhat lighter nature at 6d. per yard, plus 20% on lengths smaller than 100 yards.

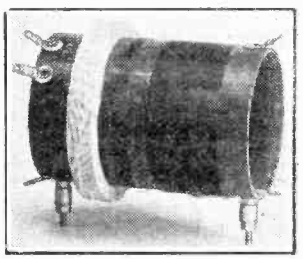
This lighter cable consists of three 14/36's and two 70/36's. By the employment of a large number of strands the cable becomes very flexible and easy to handle, despite its large current-carrying capacities.

Messrs. Ward and Goldstone point out that either cable can be employed with five-pin plugs and five-pin valve holder connectors of the flush-mounting type. A most convenient and neat scheme.

MAGNUM DUAL-RANGE COIL

Messrs. Burne-Jones & Co., Ltd., 296, Borough High Street, London, S.E.1, have produced a Dual-Range Coil to retail at the attractively low price of 2s. 6d.

It comprises three windings on a stout bakelised former. The medium-wave and reaction windings are of enamelled wire, and are straightforward single-layer solenoids, while the long-wave winding is in multi-layer form, and for this latter cotton-covered wire is used.



Half-a-crown is all this new dual-range coil costs. There are three windings on a stout bakelised former, and a separate aerial coil can easily be wound on if desired.

The connections are taken out to soldering tags, and I would suggest to Messrs. Burne-Jones that their coil would prove even more popular among home constructors if a terminal model were to be made available, perhaps at a slightly increased price.

A good feature is that the reaction winding has its two ends free, and this renders the coil adaptable to a greater number of different circuit arrangements.

The coil provides for a tapped aerial connection, and I cannot say I care much for that. Break-through of medium-wave stations on to at least the lower part of the long-wave band almost invariably accompanies a direct aerial connection.

However, with this unscreened Magnum coil there is nothing to prevent the constructor from winding on a separate aerial coil himself. The job is a quite easy one.

Tested as a straightforward aerial coil, I found the results given to be right up to standard in point of waverange and general efficiency. The 185 to 560 metres approximately with an aerial of average dimensions was excellent coverage on the medium waves, and the 850 to nearly 2,000 metres on the long waves was also perfectly adequate to cope with the new ether conditions.

Jottings of Interest to Buyers.

By G. T. KELSEY.

NEARLY a month ago I forecast in my notes that the "Bifocal Three," incorporating the great new principle of focused radio, would create a tremendous sensation. That much seemed certain on the merits of the scheme alone.

To-day, as I write these notes, I have before me press cuttings from practically every part of the country testifying to the enthusiastic way in which focused radio has been received. Without exception, all of them are eulogistic about the merits of the scheme, which at last makes distant listening worth while, and in every quarter the principle is hailed as the greatest development for years.

While we are pleased, quite naturally, that "P.W." was able to give you exclusive practical details before you read about it in your daily paper, the spontaneous way in which the Press of this country has acclaimed the development is proof, if proof is wanted, of the universal confidence which is placed both in the future of focused radio and in the recommendations of "P.W."

I make no apologies for the fact that this is the fifth consecutive week in which I have started my notes with a reference to focused radio, for the simple reason that, in order of importance, the "Bifocal Three" is the topic of the day. Thousands upon thousands of "P.W." readers have already decided to make the "Bifocal Three" their set of the future, and others are on the brink.

Take my tip, if you want radio as it should be don't even stop to think about it. Follow the lead of the experts and build the "Bifocal Three," for what is good enough for the technical experts of nine of Great Britain's leading radio component manufacturers is surely good enough for you!

A New H.F. Metal Rectifier.

An entirely new metal rectifier for use at radio frequencies up to 1,500 kilocycles has just been released by Westinghouse.

When the original "Westectors," or "cold" valves, as they were popularly termed, were first released, the old difficulty of capacity due to the use of a large area of rectifying element had been virtually overcome, and on frequencies up to about 200 kilocycles they were entirely satisfactory.

It was recognised, however, that these first introduced units, although functioning perfectly as rectifiers, failed to be practical at frequencies appreciably above 200 kilocycles, on account of the heavy damping thrown on the circuit.

The new "Westectors," to be known as the "WX" type, have been designed to overcome that objection, and they function perfectly on frequencies up to 1,500 kilocycles. The first one to be released is the WX.6, and it is provided with a distinctive blue and white label to distinguish it at sight from existing types.

Ferranti Conversion Charts.

Wavelength conversion charts for the original Ferranti Superheterodyne receiver type A1, and for their present "Gloria" and "Arcadia" models, can be obtained from Ferranti Ltd., Hollinwood, Lancs.

Interested readers can obtain them free of charge, but kindly mention POPULAR WIRELESS in your application.

(*Continued on page* 26.)

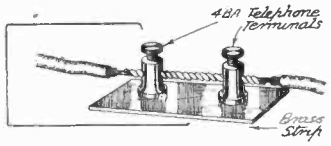
Recommended WRINKLES

STRONG AERIAL JOINTS.

HOWEVER undesirable it may be in theory, it is sometimes necessary to make a joint in the aerial, and usually it is in such a position as to render soldering difficult.

With a few oddments from the junk box a little device can be made up which will not only ensure sound electrical contact but will guard against the possibility of the wires being pulled apart.

Take a strong strip of sheet brass (say 2 in. × ½ in.) and drill in same



The wire is secured by the terminal screws.

two 4 B.A. clearance holes (say 1¼ in. or 1½ in. apart). Now procure two 4 B.A. terminals of the old telephone type. Pass one over each wire to be joined before firmly twisting the bared ends together. (Some 2 in. should be bared on each wire for this purpose if they are insulated wires.) Now slide the two terminals down to the joint and attach the brass plate to their shanks, and screw down the nuts firmly with small spanner or pliers.

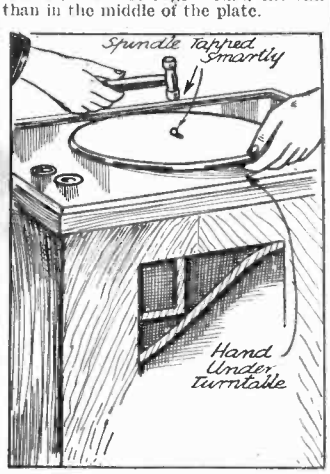
The set-screws on the heads of the terminals must also be screwed down tightly and the joint is complete. The wires cannot now possibly come apart while the brass strip provides an additional path of low resistance across the joint.

The whole can be protected from corrosion, if desired, by covering with insulating tape.

TURNTABLE REMOVAL.

I WISH to offer you a suggestion for the removal of gramo turntables.

Having been in the business for a number of years, I know the dangers of too much strain. An obstinate turntable would probably go out of true or possibly crack, as they are only cast and are much stronger round the rim than in the middle of the plate.

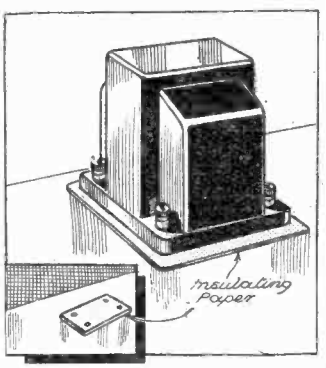


Distortion is avoided if a turntable is removed in this manner.

The best and safest method is to take up the play in the spindle shaft by inserting finger tips between plate and cabinet, when it will be found to lift about ⅛ of an inch. Hold up in this position, without applying any force, with one hand, and with a light-headed hammer give a smart tap on top of spindle and the plate will be free.

METALLISED BASEBOARDS.

FOIL-COVERED and metallised baseboards are very useful in many respects, but when mounting such components as valve holders and resistances thereon great care has to be taken to see that shorts to earth do not occur.



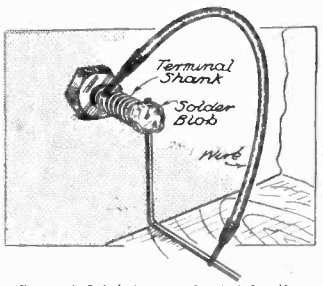
How components may be insulated from a metal baseboard.

Inexpensive mass-produced parts—particularly resistance holders—seem to be the worst offenders, many of their screws actually protruding below the bakelite moulding, so that a short to the baseboard is inevitable. If, however, a piece of paper, carefully cut to size, is placed under each component before screwing down, the risk of a short occurring is greatly reduced.

A TEST FOR JOINTS.

AFTER testing components for causes of poor or no results, it is worth while trying the soldered connections to the terminals, as what is known as a "dry joint" may be the cause. These joints are the result of an insufficiently heated iron and badly cleaned parts.

The solder, instead of having a strong hold of the face of the shank, links itself to one or two of the threads with a thin layer of dirt and flux between. Mechanically this is strong, but electrically a failure, as, after a time this layer completely insulates the two parts.



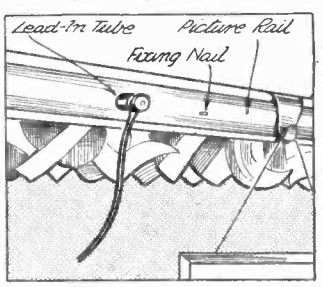
Suspected joints are shorted by the test lead.

So it proves that "one job at a time" is true; always make each connection a job on its own. To test for a "dry joint," all that is needed is a piece of wire to bridge the joint, as in sketch.

FIXING A LEAD-IN.

WHEN door, window or ventilator is not conveniently located for a minimum length of aerial down-lead in a brick building with inside plastered walls, the danger of damaging the plaster unduly is disturbing.

A simple means of locating the brickwork joint at the desired point is to examine the picture rail closely until in the paint or varnish one can see the putty covering the fixing nail; at this spot a wooden wall plug is under the picture rail in the mortar joint. Therefore at this level, about 3 in. away, drill a ¾-in. diameter hole in the picture rail with a "keen-cutter" wood bit, until the mortar is encountered. Now, with a piece of ¼-in. diameter iron rod, 12 in. long and flattened to screwdriver shape at one end, continue to tap the mortar out of the joint, twisting the rod during the tapping with a hammer. When the rod has been tapped right through the wall, one has a neat hole for the insulated lead-in tube.



The lead-in tube is brought in through the picture rail.

ONE GUINEA FOR THE BEST WRINKLE!

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 1s. will be paid for the best Wrinkle from a reader, and others published will be paid for at our usual rates.

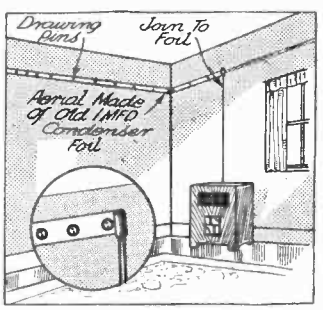
Each hint must be on a separate sheet of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear.

The best Wrinkle last week was sent by Mr. M. B. Fitzgerald, 38, Hargate Lane, West Bromwich, Staffs.

AERIALS FROM CONDENSERS.

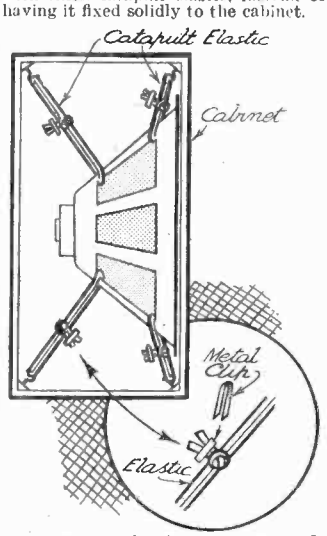
IF you have an old paper dielectric condenser in your junk box, remove the pitch at the bottom and draw out the paper foil. Unroll same and cut off 25 ft. Open one end, pare lead coating, take a piece of rubber-covered flex about 8 ft. long, strip off the rubber about an inch from one end, place in the fold of lead foil and bind up tightly with sticky tape. Attach to picture rail, as shown in diagram, either with drawing pins or glue; couple flex as down lead to set, thus making a complete indoor aerial.



How lead foil may be used for an indoor aerial.

AN ELUSIVE RATTLE

FOR some time past I have been troubled by an elusive rattle from my loudspeaker cabinet, and I cured it recently by simply suspending the speaker chassis from the cabinet with thick catapult elastic, instead of having it fixed solidly to the cabinet.



A loudspeaker chassis can be suspended by elastic to overcome rattles.

I screwed four cupboard hooks into the corners of the cabinet, and from these ran lengths of the elastic to convenient points of the loudspeaker chassis, pulling the elastic taut to prevent the unit sagging when moved.

To prevent the knots in the elastic slipping I pinched stout lengths of lead around the loose ends, as shown.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

"WORSE ON LONG WAVES AND NO REAL PUNCH."

F. P. (Warwick).—"Can you help with my set? It works, if you call it 'works,' but not like an S.G., det. and power should do.

"It is worse on long waves and no real punch. What can I do?"

Without more symptoms on which to base a diagnosis it is difficult to estimate the precise cause.

Inability to obtain proper reaction effects, for example, will prevent such a set from giving satisfactory results, especially when an indoor aerial is used, as in your case. This type of aerial will invariably affect long-wave results more than it does the reception from the medium-wave stations.

Lack of proper reaction may arise from a multitude of causes, including insufficient voltage on the detector, a reaction condenser with too low maximum capacity, a high-resistance contact, etc.

The lack of voltage may be due to an overloaded mains unit or worn-out battery.

Check up the voltages when the set is working, and if these are in order you will find one of the following is the cause of the trouble: Faulty component; wiring error or high-resistance joint; faulty valve; inefficient aerial-earth system; insensitive loudspeaker.

If the valves, loudspeaker and aerial-earth system prove to be O.K., the best way to locate the fault is to check results stage by stage, preferably with a pair of phones, or failing that by a really sensitive loudspeaker.

The idea is to first try out the set as a one-valver by joining the aerial lead to the coupling condenser between the S.G.'s anode and the detector grid-coil, and by connecting the phones (or loudspeaker) in the place of the L.F. transformer primary (H.T.+ and A terminals).

(Or, if resistance-coupling is used, in place of the detector's coupling resistance.) This cuts out the S.G. and last valve, and allows you to listen to the detector alone.

When the aerial is replaced in its original position the effect of adding the S.G. stage will tell you whether this valve is "pulling its weight." And, finally, you can bring in the last valve by restoring its output connections, to test this also.

Such tests, however, require a certain amount of skill and practice in wiring alteration, etc., so they should be carried out by someone of experience in set construction.

ANODE CURRENT CONSUMPTION AND THE CORRECT H.T. BATTERY TO USE.

C. C. (near Gravesend).—"It looks like being a long time before we get the electricity mains up to this house, so I propose to run the set from H.T. batteries at first and change over to a mains unit later on.

"It is the 'S.T.500' circuit, and I suppose it will be too powerful for the small type of H.T. battery. I know it is more economical to get a big battery rather than try to make do with smaller ones which cannot cope with the demand on them, but I do not know how much to allow for Class B, as this will be my first experience of it."

When using the valves and voltages specified for the "S.T.500" the total anode current will be only about 8 to 10 milliamps when no programme is being received. But the current rises when the loudspeaker is active, and may go up momentarily to as much as 20 or 30 milliamps, depending upon the strength of the programme.

(As you apparently realise, the anode current is not steady for Class B working, but is proportional to the volume which is being handled.)

Thus over a period of normal reception the average H.T. current would probably be of the order of 15 milliamps, the actual figure depending upon the level of volume which you obtain. The power type (double or triple-capacity) H.T. battery is therefore recommended, as these will give lower running costs in the long run than the smaller type.

A MILLIAMMETER READING WHEN A CONDENSER IS IN SERIES WITH IT.

G. B. A. (Trumpington).—"As a matter of curiosity I wired up the suspected condenser (it is a .0002 mfd.) in series with the milliammeter, and connected first a grid battery and then, getting no reading, an H.T. battery right across the two.

"When the plug is in the latter at 120 volts or so I get a small but quite definite reading on the milliammeter if connected the right way round, and a similar small but *reversed* reading when the battery connections are changed over.

"Does this show the condenser is faulty?"

Yes, quite definitely. There should be no steady reading, as the condenser should be equivalent to a complete break in the circuit.

In such a test, however, when first connected the milliammeter will often "kick" as the condenser (if of sufficiently high capacity) charges through the instrument, so no notice need be taken of a momentary reading when it is first connected.

But there should be no steady flow, and if a permanent deflection, however small, is obtained on the milliammeter the condenser is definitely faulty.

SHORT-DISTANCE LOUDSPEAKER RECEPTION ON A CRYSTAL SET.

Should this catch the eye of the reader referred to, perhaps he would like to advise a "P.W." pal, who writes from South Africa, as to the circuit he uses.

The letter, which is self-explanatory, is as follows:

"Having seen the note in POPULAR WIRELESS dated December 23rd, 1933, in which 'F. W. W.' (Woodford Green) states that he works a loudspeaker with a 3-volt battery and a crystal set, I kindly ask if I can have a plan of same.

"I have been using a crystal set for the last nine and a half months, and find in it a very interesting hobby. But seeing that it can be used to work a loudspeaker I should like to try.

"Our new station is opening, as perhaps you know, very shortly, and is to work on a wavelength of 500 metres. I live approximately, as the crow flies, six and a half miles from it.

"Thanking you in anticipation,

"Yours sincerely,

"LOUIS NANTON.

"Beatrice Cottage,
"Coronation Road,
"Maitland,
"Cape Town, South Africa."

PICKING UP TELEPHONE CONVERSATIONS.

We have recently received inquiries from readers who find their sets unexpectedly capable of picking up unwanted conversations from telephone subscribers, etc.

This peculiar effect (fortunately it is a comparatively rare one!) would generally appear to be due to some unusual local condition, such as an aerial wire running close beside the telephone line, the use of a common earth, or similar circumstance.

Any such possibility of interlinkage should be guarded against; but when it proves impossible to locate the cause of the fault it is best to drop the local postmaster a line, to see what can be done by the other parties to eliminate the effect.

Naturally, they will be pleased to assist. And some idea of the "trickiness" of such

(*Continued on page* 24.)

STATION IDENTIFICATION

TRIESTE

Trieste's transmissions are in a difficult-to-place section of the waveband, unless you know Cork's dial reading. In that case Trieste will appear about two degrees higher, on 245·5 metres.

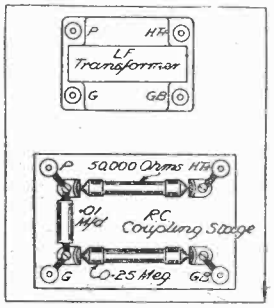
* * *

Failing Cork, as an aid to identification, Gleiwitz or Lille will do, Trieste being immediately above the former and below the latter dial reading. Its "placing" with regard to British stations is just about halfway between the London (or West) National and Aberdeen dial readings.

* * *

Trieste's power is 10 kilowatts. The usual announcer is a lady, and the programmes are linked with Turin (pronounced "Torino"). Trieste is pronounced like "Tree-ess-tay."

CHANGING OVER TO R.C. COUPLING



It is sometimes desired to change a low-frequency transformer-coupled stage to resistance-capacity coupling (i.e. a stage employing two resistances and a small condenser, instead of the transformer).

* * *

The R.C. components—usually of the values shown above—are often assembled in the form of a unit. Its terminals can be marked "P" (or "A"), "H.T.+," "G" and "G.B.," like the transformers, as indicated.

* * *

To change over, all that is necessary is to remove the transformer and wire up the corresponding points.

WHAT SET IS YOURS?

FOR EVERY SET ON THE MARKET THERE IS A SUPER-LIFE GROSVENOR BATTERY

For instance, is yours a

KOLSTER BRANDES

There is a Super-Life Grosvenor for every Kolster Brandes Model. Ask your Dealer.

WHATEVER the make, you would get the *most* out of your set with a Grosvenor Battery. A Grosvenor would give it just the silent, superabundant power it needs—and last far longer than any battery you have ever had. The Grosvenor MERCURY process is the secret—guarding against corrosion and enabling the cells to be hydraulically crammed with *extra* chemicals.

Next time, insist on a Grosvenor. There is one made for your own particular set!

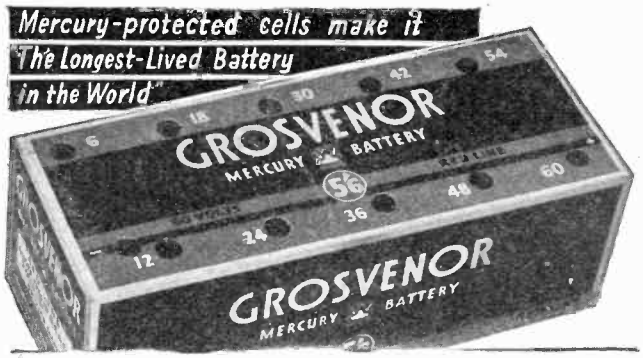
or, if yours is a

MURPHY

your Dealer has a Super-Life Grosvenor made specially for your set.

KOLSTER BRANDES K.B.247 Pup. Ask for Grosvenor DBA546 (99+7½v.) 10/-
KOLSTER BRANDES Hika Trans. S.G.4. Ask for Grosvenor DBA546 (99+7½v.) 10/-
MURPHY B.4. Ask for Grosvenor DBA284 (108v.) 13/-
MURPHY B.5. Ask for Grosvenor DBA539 (135+9v.) .. 13/-

Mercury-protected cells make it The Longest-Lived Battery in the World



GROSVENOR ELECTRIC BATTERIES, LTD.,
2-3, WHITE STREET, E.C.2. Works: Watford, Herts.
Telephone: METropolitan 6866 (3 lines).

A delightfully cool sweet smoke, burning free and evenly .... an Empire Blend of the highest quality.

PLAYER'S

AIRMAN

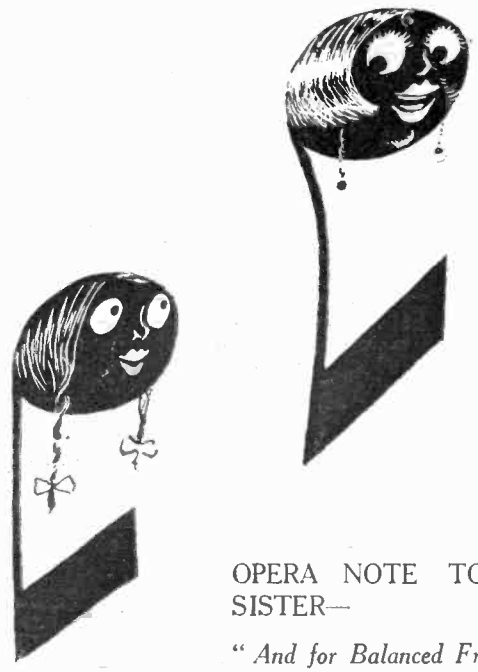
MIXTURE

ALSO AIRMAN NAVY CUT AND FLAKE — 10°oz
NAVY CUT DE-LUXE 11°oz

10D PER OZ

P.A. 37 C.

the technically supreme valve at economy prices



OPERA NOTE TO LITTLE SISTER—

"And for Balanced Frequency Response—tone without loss of volume, my dear—use a Tungsram valve! Why, I always thought I was only the scenery squeaking—and now it turns out that I'm really the soprano's best top note!"

Highest performance, due to unrivalled technical resources! Yet moderate prices! Experts always choose Tungsram—for quality, power and sensitiveness. The way they rejuvenate old sets is nothing short of marvellous. There is one for every radio need—write our Technical Dept.

TUNGSRAM

VALVES

Tungsram Electric Lamp Works (Gt. Brit.) Ltd. 72, Oxford Street, London, W.1

ELECTRADIX MICROPHONES

WE HAVE THE VERY BEST.
A Range of Models to suit Every Purpose.

20 designs to select from, each suitable for its particular job. All tested in our own Lab. before despatch and guaranteed. Complete mikes from 5/6. Send for special illustrated list "P."

HOME RADIO MIKES.

New Designs for Home Broadcasting on your Radio. Bakelite cases, metal grille. No. 11 Solo. **5/6** Type No. "P.W." 11 Table, with high ratio transformer in case **10/6.**

No. "P.W." 11 10/6

No.11, 5/6.

"P.W." CONTINUITY TESTERS, 7/6.

Bakelite case with test bulb, battery and switch. Test Prods and pair of Headphones and Cords, **7/6.**

PHONES (120 ohm Sullivan). All one type and new. Aluminium body and headbands. Makers' price today is **15/-.** Our price **2/6** per pair, **3d.** postage or **4/6** for 2 pairs, post free.

THE DIX ONEMETER.

COMPLETE IN CASE **60/-**

The ideal of multirange, moving coil meters. Built to first-grade British Engineering Standard. 50 ranges on 1 meter. Measures Microamps to 20 amps, millivolts to 2,000 volts, 50 ohms to mehogms. Six terminals. Two clear scales, mirror, and knife-edge pointer for accurate reading. Multipliers extra.

Send stamped addressed envelope for Radio Bargain List "P."

ELECTRADIX RADIOS,
218, Upper Thames Street, E.C.4., *'Phone Central* 4611.

PERMANENT H.T.

Dead silent background.

Any voltage supplied.

LASTS YEARS AT LITTLE COST

Why continually dip into your pocket for costly dry battery replacements and then endure poor results when they run down? Why not decide, as thousands of others, to end the problem *for good* with a Standard Leclanche Battery? Gives super pure current year in year out. Maintains voltage amazingly. Recharges itself overnight. Annual replenishment at small cost all that is necessary. Invest in this money saving permanent H.T. **NOW**—pays for itself over and over again. **120v. 12,500 m.a. £2 complete.** Carr. paid. **Read these interesting letters.**

—MORE AMAZING PROOF

"Had your battery in use for 2½ years, think it best solution to H.T. problem. I study economy as much as performance."—A.R.P., Dagenham.

"I have used battery for last 5 years and have found it good and superior to dry batteries."—J. M., Edinboro'.

"14 months going every day on 3v. set and still kicks up 80v."—E. K., Reading.

All STANDARD Battery Spares Supplied.
WET H.T. BATTERY CO. (P.W.),
26, LISLE STREET, LONDON, W.C.2.
Gerrard 6121.

PLEASE be sure to mention "POPULAR WIRELESS" when communicating with Advertisers. THANKS!

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 22.)

cases may be gained from the following interesting letter to the Editor from Mr. L. J. Little, of 6, Norfolk Crescent, London, W. :

"I think the following might be of interest, but am at a loss for an explanation. This house, a four-storey one, has a G.P.O. telephone extension on each floor.

"When the telephone on the *first* floor is being used my receiver picks up the two-way conversation at full strength.

"The curious part about it is that it only comes through on the London National and Regional wavelengths, and only when either of these stations are working.

"I might add that the extension is at the front of the house and my aerial is outside at the back.

"P.S.—My receiver is situated in the basement."

FITTING A PICK-UP FOR GRAMOPHONE REPRODUCTION.

F. F. Y. (Cardiff).—"You may be surprised to hear it, but I am still using the set you gave in blue print form on October 11th, 1930. It was one on a sheet of four, and was called the 'Maxipower,' four valves.

"About six months ago I put it aside for a new one, going cheap, but after a few weeks of ups and downs, crackles and uncertainty, I went back with a sigh of relief to the 'Maxipower.'

"The sole advantage that the other had was that it was capable of playing gramophone records. I suppose the 'Maxipower' could be supplied with terminals for this.

"If you will describe the alterations in words I should like to have a go at it. I have got a Bulgin S86 switch on hand, which I am told is O.K. for this purpose."

The switch in question is suitable, and should be mounted on the panel between the ·0005-mfd. variable condenser O2 and the filament resistance.

The two leads connected to the grid terminal of V2 should be disconnected from this point and connected instead to the centre terminal of the radiogram switch.

One outer terminal of this switch should be connected to the grid terminal V2.

The other outer terminal of this switch should be connected to a "pick-up" terminal mounted as one of a pair on the terminal strip. The other "pick-up" terminal should have a flex lead attached to it, carrying a black plug, to connect to the appropriate negative-bias socket on the grid-bias battery.

When the pick-up leads are connected to these terminals you should get the required results, but you may find that the indicator of the radiogram switch reads incorrectly—"Gramo" when working radio, and vice versa.

If this happens all that is necessary to correct the indicator is to change over the two connections to the outer terminals of the radiogram switch.

NEXT WEEK

FULL DETAILS OF HOW TO MAKE

AN ULTRA-EFFICIENT WAVE-TRAP

A simple and inexpensive unit that will cut out interfering stations and improve your selectivity.

WEDNESDAY PRICE 3D.

INEXPENSIVE VALVES

I WONDER how many valves there are on the British market. Many hundreds, of course, so that the choice of an exact type to fit a particular need is quite easy—if you know the valve types well. They are not classified in any fixed nomenclature scheme, so that comparative tables are invaluable when you want to pick out a valve for any particular purpose.

I have been inspired to write all this by the arrival of a batch of Dario valves for test and by the clear, sensible list that accompanied them. This list contains not only the full complement of Dario valve types, with their various characteristics, but also a most useful comparative table that shows at a glance how Dario valves fit in with other makes. It is a useful list, and I shall keep it handy for future reference.

A Huge Range Covered.

Turning to the valves themselves, I must say at once that it is impossible in this space to give more than a glimpse of the huge range covered. There are eleven two-volt battery valves, including a Class B valve; fourteen A.C. valves—twelve being of the indirectly-heated type—and four rectifiers, covering 400 volt half-wave 60 m/a., 300 v. full-wave 75 m/a., 350 v. 120 m/a. and 500 v. 120 m/a.

The 9-watt dissipation directly-heated pentode (TE434) at 12s. 6d. is a fine proposition. It has an amplification factor of 130 with a mutual conductance of 3·5. With 250 volts H.T. it will give something like 3–3·5 watts output. There is also an indirectly-heated counterpart in the TE634, which has a mutual conductance of 2·7 and impedance of 37,000 ohms. It also dissipates 9 watts at 250 volts H.T. Price 12s. 6d.

Battery-set owners will do well to consider the variable-mu S.G. valve (TB452), which is excellent value at 10s. 6d., while the Super detector (TB172) at 5s. wants some beating. This valve has an impedance of 13,000 ohms.

Versatility and Cheapness.

The Class B valve (TB402) is of the zero grid-bias variety, and costs only 10s. 6d. It has a good power output and takes up to 150 volts H.T.

And so I could go on—picking out valves here and there to show the versatility and remarkable cheapness of the Dario valves. They are good valves, and as such deserve due recognition by set owners. The list I have been looking at gives all the details you require to enable you to pick any valve you may need, and should certainly be in the hands of every set constructor. Dario will be pleased to send it free if you write for list DV2.2.34 to Impex Electrical Ltd., 47, Victoria St., Westminster, London, S.W.1, and mention that you are a reader of POPULAR WIRELESS.

K. D. R.

INCREASE THE SELECTIVITY OF YOUR SET!

2/- WITH HANDY HOLDER 2/6

OVER 1,500,000 LISTENERS USE A——

to separate those stations that overlap each other. Get rid of that annoying muzziness that spoils local reception. Just **FIX A PIX** in your aerial-lead. You will be surprised how sharply your set tunes; and delighted at the number of new stations you can hear clearly. Try one to-day. Send us 2/-. If you are not completely satisfied, return it to us within 7 days for full refund.

BRITISH PIX CO., Ltd., LONDON, S.E.1.

P/X

PERSONALITIES AND PECULIARITIES AT THE BIG HOUSE

(*Continued from page 15.*)

balancing of all transmissions. Within the limits of the resources and policy laid down for him, Mr. Wellington does a very fine job. His usefulness would be further enhanced if he were able to get more into touch with intelligent outside opinion.

In the Talks part of broadcasting Mr. Lionel Fielden deserves notice. To him is due the credit for most of the new ideas and liveliness that have made the talks so much more acceptable in the past year. It is fortunate for the B.B.C. that they have managed to keep Mr. Fielden. He is one to whom any suspicion of bureaucracy is anathema. With more authority he can accomplish much more in his present field.

New Blood Required.

Mr. Walton O'Donnell and Mr. Joseph Lewis are the two conductors to be commended next to Dr. Boult. The former has evolved the finest military band of its kind in the world; the latter handles those programmes of popular music, which assuredly have bigger appreciative audiences than any other broadcasting features.

Mr. Stuart Hibberd, the chief announcer, more than holds his own. He has gained in popular favour since he began recently to put more of his own personality into his work. Let this tendency go on, and Mr. Hibberd, supported by Mr. Freddie Grisewood, will gain a reputation as great as, if not greater than, the chief American announcers.

Other broadcasters whose "stock" is rising, either inside or outside Broadcasting House, are Messrs. John Watt, King-Bull, Lance Sieveking, Henry Hall, John Sharman, Howard Rose, Stanford Robinson and R. A. Rendall.

Comparing the present situation with that surveyed similarly every year for eight years, one suggests that the same names crop up frequently. No doubt they deserve to, but it would be better for the health of broadcasting to see new names alongside the established ones.

THE MIRROR OF THE B.B.C.

(*Continued from page 6.*)

the Scottish "Points of View" series of talks on Internationalism, which should not be confused with Scottish Nationalism, in whose interests Sir Alexander McEwen was formerly candidate for Kilmarnock.

We can take it that Mr. Maxton's views will uphold the brotherhood of man, and that Sir Alexander will be equally emphatic in stating his beliefs in the essential right of small nations to live their own lives.

Van Phillips' "All-Stars."

What do you know about Van Phillips, whose All-Star Orchestra is to present an hour of popular music in the modern manner in a programme for National listeners which Christopher Stone will announce, on Monday, March 26th?

Van Phillips is an American, and although he came to London in 1925 to play the saxophone in the Savoy Hotel bands, he is

(*Continued on next page.*)

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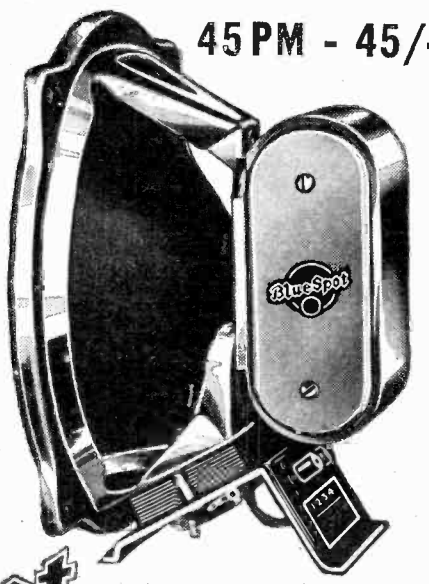

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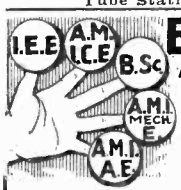

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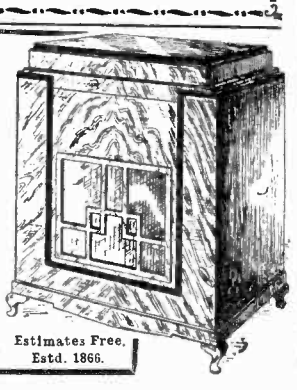

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THE MIRROR OF THE B.B.C.

(*Continued from previous page.*)

still not yet thirty. He left his job to take up arranging and to write his own music. "The Two of Us" was one of his "hits."

Since then he has been studio manager for a gramophone company, has made records with his own band, has scored two revues ("Bow Bells" and "Fanfare") and has done orchestrations for "Nymph Errant," "Gay Divorce," "Mr. Whittington" and "Ballyhoo."

With hundreds of arrangements for dance bands—Jack Payne's, Ambrose's, Henry Hall's, Marius Winter's and Roy Fox's among them—to his credit, it is to be expected that he will do the same for the programme he is to direct on March 26th.

An Orchestra of Soloists.

How he found time to do it all is a mystery, because he is now scoring and directing music for films, of which a selection from the recently completed "Love at Second Sight" will be in his broadcast.

And what, too, do you know of his All-Star Orchestra? It is one of those combinations that can only be got together occasionally, consisting as it does mainly of soloists, more than half of whom have appeared in radio programmes.

The hour which has been given to this programme should be outstanding.

TELEVISION— ALL-ELECTRIC SCANNING

(*Continued from page* 11.)

In the anode is a very small hole, and the effect of this is important; it allows a tiny stream of electrons to pass through and shoot out on the farther side of the anode, where they keep on going as a result of their high velocity.

The result is a sort of "ray" of electrons travelling at high speed, and the tube is so made that this stream falls upon a large, flat surface of glass at the end. This is shown in the sketch on page 11, and it makes the ray visible by virtue of the phenomenon of fluorescence: the glass is coated with a substance which emits a glow of light when an electron stream falls upon it.

A Tiny Spot of Light.

Thus, if the ray is made to remain in one place, we see a single tiny spot of bright light on the flat end of the tube, and if we could make this move about and vary in brightness in the usual way we should have a complete television receiving system.

Just how that is actually done must be a subject for my next article, but I must give just a hint at the method here. Very briefly it is a matter of putting charged electrodes on either side of the electron ray and causing it to bend one way or the other, according to the usual laws of attraction and repulsion.

This bending of the ray naturally shifts the spot on the screen at the end of the tube, and so gives our basis for a scanning system.

RADIO SUMS SIMPLIFIED

Owing to extreme pressure on space, this feature of our Special Beginners' Supplement has been unavoidably held over this week.

THE LISTENER'S NOTEBOOK

(*Continued from page* 6.)

the average for interest. So I softened somewhat towards the Foundations this week, though I am pretty certain to break out again before long. I am usually averse to the average sort of chamber music. I never feel such music was intended for entertainment. I go so far as to think that a lot of it was never meant to be heard outside the practice-rooms of a musical college.

I am no authority on chamber music, but it always strikes me as being ideal music on which player-musicians should practice, especially those who hope to perform in orchestras or smaller combinations, when the art of playing together has to be mastered. I can say no more for it than that.

* * *

The St. David's Day celebrations followed the usual form of these national celebrations. There were excerpts from Welsh history, with a couple of narrators declaiming more than ever and literally bursting with importance. Though these chapters are interesting enough, they aren't as terribly exciting beyond the border as they are within it. There was something very incongruous, however, about the inclusion of a famous Rugger match, as it preceded a piece of quite ancient history.

* * *

If there should be a sudden outbreak of errand-boy whistling in your street you must blame John Southern and his Hour of Old-Time Music-Hall Hits. We asked for more old music-hall songs, and we are getting them thick and strong. Almost every week, now, something of the sort is put on. The Southern Hour is certainly the most ambitious that has yet been conceived. It was the real stuff, of course. And what a triumph for some of those famous old artistes! Their performances made one wonder why they ever retired.

Mr. Charles Austin was great. So was young Bill. He quite deserved to have his name on the programme. The humour of this pair was first class, but I thought the patter of some of the artistes was a bit feeble in places. Their songs are gems. More of these shows of a Saturday night, if you please! You can't beat 'em.

* * *

Miss Dorothy Sayers gave a rather amusing account of a week's doings. A series of irritations, surprises and vexations (especially those occasioned by a certain newspaper's correspondence columns) must have consoled many listeners who find life pretty much the same. Miss Sayers should expect another surprise this week, this time from her publisher in the shape of a memorandum reporting an increase in the sales of her books.

C. B.

THE LINK BETWEEN

(*Continued from page* 20.)

Scales calibrated to meet the new wavelength conditions can also be obtained for the Radio for the Million "Stationmaster 34" and Stationmaster Class B" receivers.

Procurable from your local dealer, or direct from Messrs. United Radio Manufacturers, Ltd., 63, Lincoln's Inn Fields, London, W.C.2. The price is 2s. post free.

British Radiophone Supers.

Two very fine "world-wide" seven-valve Q.A.V.C. superheterodyne receivers have just been produced by the British Radiophone, Ltd. They were shown at the British Industries Fair for the first time.

The "Continental" is an all-wave model designed for reception from 10–50 metres, from 200–550 metres and from 1,000–2,000 metres. In the design of the "Empire" model the long-wave band is excluded.

Both models are available as complete receivers with valves, moving-coil speakers and specially treated pinned teak cabinets, or alternatively they can be supplied in chassis form.

Just the very thing for overseas listeners in remote corners of the Empire. Full details from British Radiophone, Ltd., Aldwych House, Aldwych, W.C.2.

* * *

More "replacement scale" news. If you are the owner of an Ekco model SH25, C25 or RG25 receiver you can obtain new scales in pairs of two sections at 9d. per pair. Available from all Ekco dealers.

* * *

Wearite have now produced a new Q.P.P. input transformer designed to match up with the Marconi and Osram Q.P.21 valves. The ratio of the Wearite transformer is 9 to 1.

A New "Ever Ready."

A new H.T. battery suitable for replacement purposes in the latest model McMichael "Lodex 5" has just been introduced by the Ever Ready Co. (G.B.), Ltd. The e.m.f. is 126 volts tapped at 70 and 120, with 6 volts for grid bias, and the price is 17s. 6d. Specify model W1252 when ordering.

* * *

Standard Telephones & Cables, Ltd., are shortly to market a range of Micromesh A.C./D.C. valves designed for series running at ·2 amp. The voltages are to be 13, 26 or 40. Full details later.

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

Electrolytic Condensers.

I CAN'T just remember how long it is now since electrolytic condensers came into popular use—I suppose it will be about a couple of years, although I recollect at least five or six years ago receiving samples of the earliest types of these condensers from the United States.

In most so-called dry condensers a cotton material is used for absorbing and carrying the electrolyte and also for spacing the anode and cathode. In an improved condenser the anode stands free of the cathode, but there is an electrolyte which is of the jelly type, something after the fashion of the jelly accumulator.

In the accumulator with jelly electrolyte—in view of the relatively large charging and discharging current—there are certain important difficulties met with, owing to the fact that the jellied electrolyte cannot flow in the same way as a liquid electrolyte.

Jelly Electrolytes.

In the case of the electrolytic condenser, however, these difficulties are not nearly so great and here the jelly type of electrolyte seems to be particularly suitable. Of course, a certain degree of "jellification" has already been used by manufacturers, whilst in ordinary dry cells (for example, high-tension battery cells) the electrolyte is often in this form.

With the jelly-electrolyte condenser there is plenty of electrolyte around the anode, so that the condenser becomes self-healing in the event of breakdown, whilst at the same time there is very little evaporation or loss of electrolyte, and this gives a longer life and more dependable working to the condenser.

In addition to these advantages it is claimed that when the voltage is applied to the condenser the current quickly drops to a very low value, and remains so even after the condenser has been working for long periods.

Radiometric Condensers.

A very interesting paper was read a little while back before the Royal Society of Arts, entitled "Radiometric Condensers and Inductances," by G. G. Blake, M.I.E.E., the well-known radio engineer.

This paper is interesting not only for the account of the experiments on the radiometric condensers themselves, but also for a large amount of information which is included on light-sensitive cells and related matters.

The light-sensitive cells, of course, include the copper-oxide type, which in one form consists of a copper electrode chemically sensitised to light by the action of copper formate in a solution of formic acid; this electrode, together with a second electrode of lead, is immersed in a solution of lead nitrate.

The Weston Electrical Instrument Company of U.S.A. introduced about two years ago a dry copper-oxide cell which, with the proper circuit, is capable of generating a current of 5 milliamps when exposed to direct sunlight. This cell, by the way, was exhibited for the first time in England at the exhibition of the Physical Society at South Kensington in 1933.

Another Type of Cell.

Another type of light-sensitive cell devised by Mr. Blake is very simple, and consists of two copper strips immersed in a glass tube containing methylated spirit—one of the strips is previously light-sensitised by heating it to bright redness in a gas or spirit flame and allowing it to cool gradually. This type of cell, when properly made, is very sensitive and remains stable over long periods.

There is a mass of interesting information in this paper which I could not possibly extract for you here, and I advise any of my readers who are interested in the type of subject indicated above to consult the original paper; it gives all manner of applications and uses for the radiometric condenser, and concludes with an immense list of references to original papers which is most valuable to anyone pursuing this subject seriously.

The Heaviside Layer.

We have all been familiar with the Heaviside Layer for many years past, and I think most of us know that in the absence of this or some such layer we should be entirely at a loss to explain the fact that radio waves travel around the curvature of the earth.

The Heaviside Layer, however, leaves much unexplained, and therefore it is not surprising that more recently a second layer has been discovered at a height of about 150 to 200 kilometres above the earth's surface.

This layer is often called the Appleton Layer, although Professor Appleton himself modestly refers to it as the "F" region, as distinct from the "E" region, which is the Heaviside Layer: this latter is at a height of about 50 kilometres or more.

I should explain that the height of these regions varies considerably at different times, and particularly with day and night.

Day-and-Night Effects.

Waves of about 100 metres or less will pass through the Heaviside Layer and be reflected by the upper layer, at any rate at night time; but during the daytime there is a certain amount of reflection even from the lower layer.

There is a growing belief that another reflecting or refracting layer exists between the Heaviside Layer and the earth's surface, and that this region is responsible, to some extent, for the absorption of short waves, which is particularly pronounced at certain times.

Notwithstanding the ingenious methods which are now available for automatic volume control, there are still many difficulties to be faced in long-distance radio

(*Continued on next page.*)

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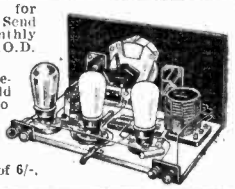

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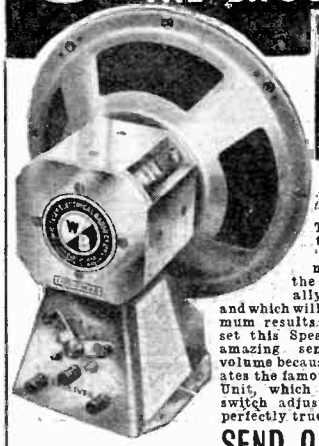

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TECHNICAL NOTES

(Continued from previous page.)

transmission and reception, and especially in connection with short-wave working which is of increasing importance in several different directions.

Therefore these investigations into the electrical conditions above the earth's surface are not merely of theoretical interest, but are of the utmost practical importance in relation to long-distance radio transmission on all wavelengths.

Automatic Volume Control.

Automatic volume control seems to have come to stay. Not so very long ago this was really standing its trial, and certainly there were quite a number of objections to it; but one by one these have been got over, and now it is used in a great number of commercial receivers not only in this country but in other parts of the world as well.

I expect anyone who uses a set employing automatic volume control will have noticed that the tuning has to be handled somewhat differently from that of an ordinary set. The set with the A.V.C. acts in some ways as though the tuning had been flattened, but there is one important difference.

In the ordinary way the set with flat tuning can be tuned quite a considerable amount on either side of the true tuning point without any very serious alteration either in the volume or in the quality of the reproduction. This is "flat tuning" in the ordinary sense of the term.

Distortion and Selective Tuning.

If you have an ordinary set which is very selective you will find that the moment you go off the true tuning point for any station you will get pronounced distortion, so that, quite apart from the question of volume, there is no difficulty whatever in knowing when the set is correctly tuned.

Now, when it comes to the set using automatic volume control you get a result which is somewhere between the two; that is, the set behaves in some ways as though it were broadly tuned, whilst on the other hand this distortion effect is still noticeable, although often not so much as with an ordinary set which is very sharply selective.

The object of automatic volume control, of course, as its name implies, is to keep the volume reasonably constant notwithstanding variations in the strength of the incoming signals, or, if you like, variations in the strength of the signals applied to the detector. When the strength applied to the detector is lessened the variable-mu valves increase in amplification and vice versa.

An A.V.C. Effect.

We can see, then, why it is that, with a set using an effective automatic volume control, we can sometimes go appreciably off the tuning point without losing very noticeably in volume—that is, a broad tuning effect—whilst at the same time, although this causes distortion, the distortion is not of that very fierce and instantaneous type that we get with a very sharply tuned receiver.

Band-Pass Filters.

I said something in these Notes a short while back about band-pass circuits, and a reader mentions something with regard to these circuits which I think is a very practical point and perhaps worth going into. The point in question is that the wiring of the circuit may often have quite an important effect upon its characteristics.

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This is due to a number of causes, amongst them the fact that by bad arrangement of the wiring you will get various stray capacities. The result of this is that instead of getting a proper band-pass effect you get a curve which is peaked or, on the other hand, too broad.

You want particularly to take care that the wires do not run too close together; for example, the connections to the tuning condenser may cause a coupling or capacity effect which will completely upset the tuning.

The Results of Inefficient Wiring.

The sensitivity and the selectivity of a set employing a band-pass filter can be affected to quite an important extent by the way in which the filter itself is wired up. My correspondent mentions that he has tested one or two other sets employing a band-pass filter identical with his own in which the sensitivity or the selectivity has been inferior owing to no other cause than the inefficient wiring of the filter.

This question of wiring applies to almost all parts of a radio receiver and is nothing new, but I don't think people always realise its importance in the little extra units and outside circuits which you sometimes add on to the main circuit.

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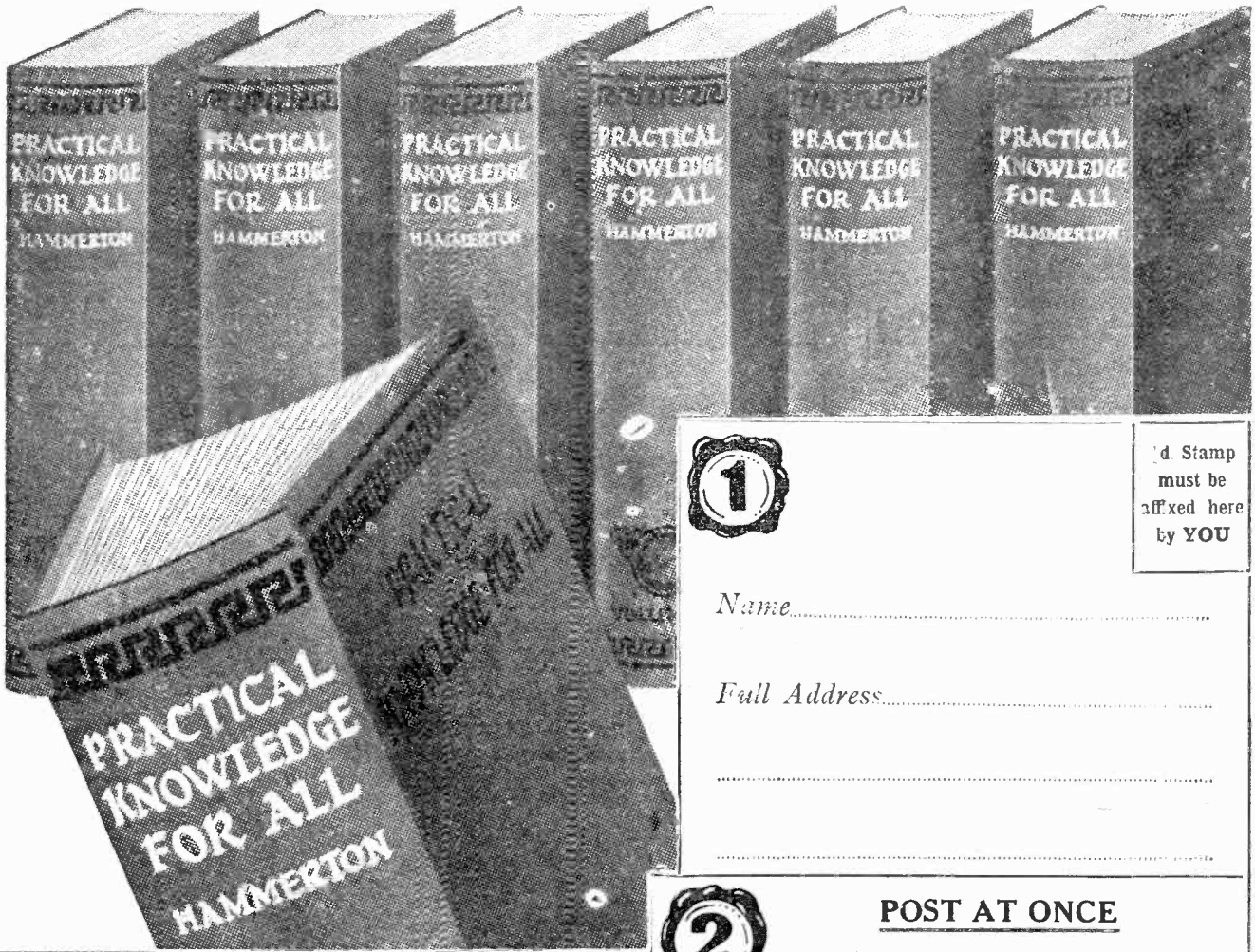

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I hereby apply for GIFT VOUCHER and request you to reserve for me in accordance with your special offer the Six-Volume PRACTICAL KNOWLEDGE FOR ALL. I have given a standing order to my Newsagent to supply POPULAR WIRELESS regularly each week.

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(*State Mr., Mrs., or Miss.*)

Full Address.....

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Reader's Signature.....

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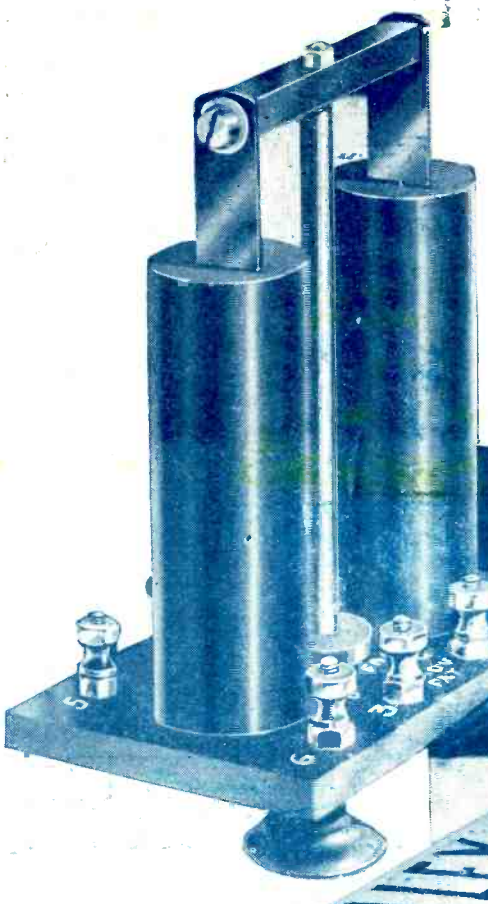

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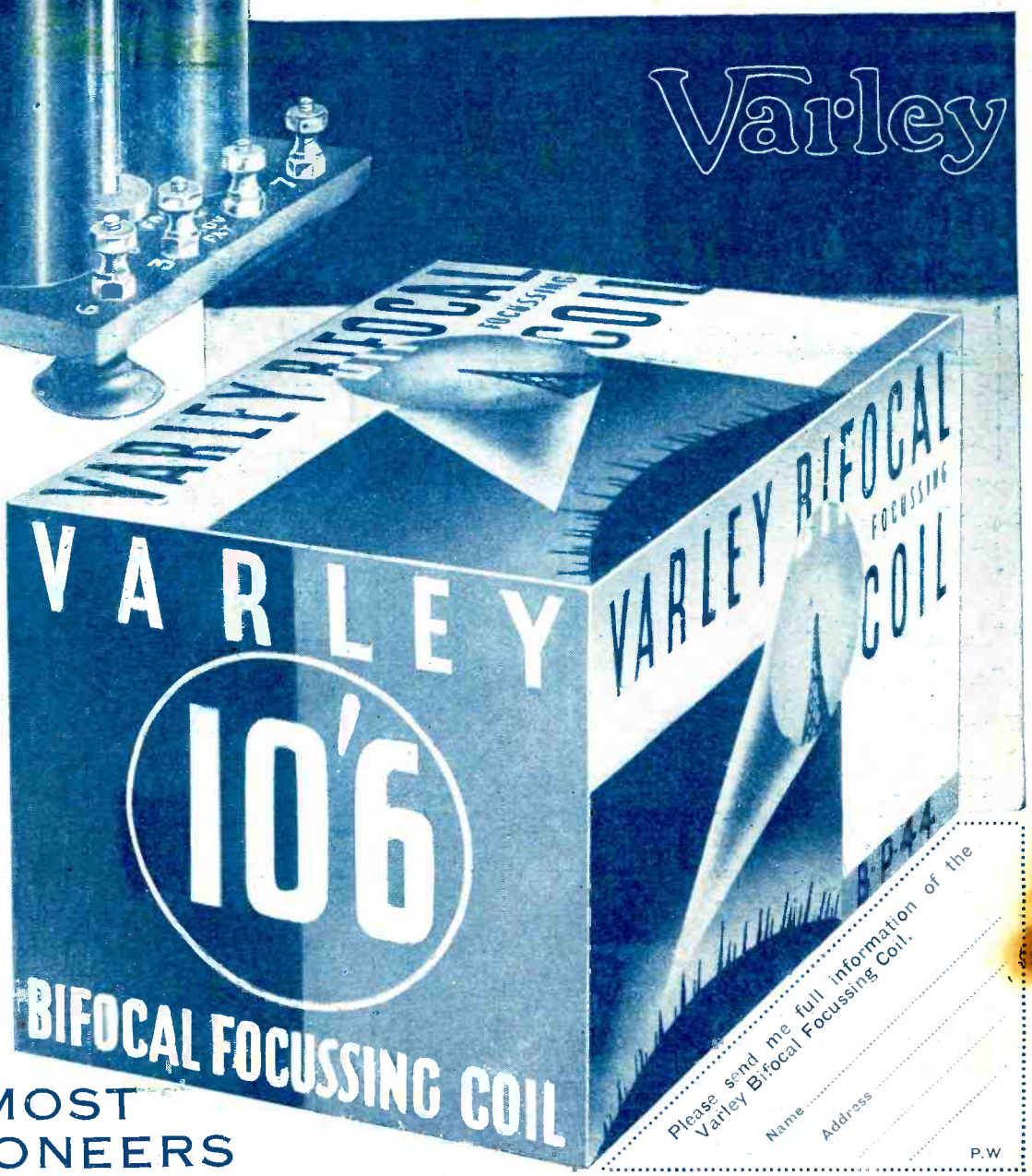

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FOREMOST AS PIONEERS

Advertisement of Oliver Pell Control Ltd., Kingsway House, 103, Kingsway, London, W.C.2. Telephone: Hol. 5303.

POPULAR WIRELESS, March 24th, 1934. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

THE FREEDOM OF THE AIR : AN ANSWER TO THE B.B.C.

A Special Article by Lord Strabolgi

Popular Wireless

No. 616.
Vol. XXV.
March 24th,
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POPULAR WIRELESS
THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

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Technical Editor: G. V. DOWDING, Associate I.E.E.
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Assistant Editor: A JOHNSON-RANDALL.
Chief of Research: K. D. ROGERS.

VISIT CHESTER
IS IT A RECORD ?
SUNDAY ITEMS
AMATEUR "B.B.C."

RADIO NOTES & NEWS

BOYCOTTING BROADCASTING
SOME HARD HITTING
RADIO AND SCIATICA
THE BIFOCAL THREE

The Eastbourne Relays.

SO we have bidden good-bye to Tom Jones—at any rate, in respect of the Sunday evening concerts at the Grand Hotel, Eastbourne, where he did such fine work.

Leslie Jeffries succeeds him, and we look to Leslie to maintain the standard set by his predecessor.

He is widely experienced in musical matters, has been music director of the Buenos Aires Casino and of First National Films here. He is a born Londoner and uses an English violin.

Blame the Radio.

ALTHOUGH the drought, if it continues, may breed more dangerous things, it has already given rise to a grim satisfaction in the minds of those of us who have consistently opposed the "radio-causes-rain" theory—if it can justly be dignified with such a name!

But we shall not fall into the error of supposing that radio creates droughts. There is little or no evidence that radio exerts any perceptible effect on climate, though it is certainly going to be a factor in the future of humanity.

Good Business!

WHO says that the English are slow in business? Our radio shows and the British Industries Fairs say "No," and so does Chester.

For Chester, in a land where the screams of competing radio advertisers are, happily, prohibited, has enterprise enough to put itself "on the air" in North America, where a discussion of the town's attractions has been broadcast from 250 stations in the U.S.A. and Canada.

You see, since the "depression" the number of visiting Americans has dropped seriously, and Chester is doing something about it. Why don't we do the same for Britain as a whole?

Poznan Up to Date.

THE reconstruction of Poznan is now completed, and the transmitter works with an (unmodulated) aerial input of 16 kilowatts, as compared with its former 1·7 kilowatts, on a wavelength of 345·6 (Lucerne).

The contractors for the new station state that the desire of the Polish authorities to be good neighbours in the ether is evident from the fact that the "crystal drive," which regulates the transmitted frequency, was ready for operation within four hours of its delivery at Poznan.

A Wireless Society Paragraph.

THE Portsmouth and District Wireless and Television Society informs me that it has made provisional arrangements for establishing a Portsmouth and Southsea wireless research and experimental station, with facilities for work on short, ultra-short, micro and television waves.

It is hoped that the station will be available to members any evening they please. For details of the society write to the Hon. Sec., Mr. S. Holland, 54, London Road, Portsmouth, Hants.

Can You Equal This?

J. T. (Roche) proudly draws attention to the fact that his set is a one-valver, home-made, will work a Blue Spot 100D L.S. on 60 volts, will receive over 30 stations, including Bucharest, and will operate with as low as 1½-volts H.T.

He wants to know if this constitutes a record.

Well, my dear man, it is a receiver to be proud of, but I expect that I shall hear from dozens of readers who own similar marvels. I'll let you know.

My Sunday Programme.

HOW does this appeal to you? 8 a.m., Silence. 9 a.m., No physical jerks. 10 a.m., News—*real* news. 10.15 a.m., Brief notes on day's programmes. 11 a.m., Service on Reg.; music by B.B.C. orchestra on Nat.—till 1 p.m., when lighter but not "hot" music.

2.15 p.m. till 3.15 p.m., *Good* talks or playlet. 3.15 p.m. to 5 p.m., "Sunday" concert—songs, orchestra, organ music. During tea, Light music. 6 p.m., Service on Reg.; talk or playlet on Nat. I mean talks by personalities who have *done* something—not text-book orators.

8 p.m. to 9.30 p.m., Full "Sunday" concert alternated with symphony concert. After that I have a bite and turn in. *You* can suggest the remainder of the show—but not to end later than 10.30 p.m.

The Great Adventure.

FIRST we had the very young magnate who ran a cinema theatre under the nose of the authorities, which organ functioned at long last and pointed him to more orthodox behaviour as a proprietor. And now the amateur "B.B.C.": a young fellow who broadcast from two transmitters, Norwich One and Norwich Two.

Though he supplied weather forecasts and gramophone music, the rumour that he had engaged Leonard Henry and Sir Henry Wood is quite unfounded. Alas! some curious engineers of the Post Office succeeded in finding Norwich One and Two, and the great adventure closed.

Radio and Newspapers.

I THOUGHT that the conflict between radio and the Press was over, but nevertheless I observe that newspaper readers are asked whether radio news bulletins lessen their interest in the daily or evening paper.

Looks to me like fishing for a compliment, for the Press fellows are not so unpenetrating as to believe that anyone refuses to

(Continued on next page.)

YOUR LAST CHANCE TO WIN £50!

The "POPULAR WIRELESS" Radio Play Competition closes at the end of next week. Your radio play should be in the hands of the Editor by March 31st at the latest. This is all you have to do:

¶ WRITE A RADIO PLAY SUITABLE FOR BROADCASTING. ADDRESS IT TO THE EDITOR, "POPULAR WIRELESS," TALLIS HOUSE, TALLIS STREET, LONDON, E.C.4. MARK YOUR ENVELOPE "RADIO PLAY" AND ENCLOSE A STAMPED AND ADDRESSED ENVELOPE.

There are no other rules or regulations. The play can be on any subject and any length you like. "POPULAR WIRELESS" will give a prize of £50 for the best play and the B.B.C. will undertake to broadcast the winning entry. Nothing could be simpler than that!

SEND IN YOUR RADIO PLAY BY MARCH 31st.

"MUSH-MOUTHED AND DOUBTFUL OF DICTION"

buy a paper because the B.B.C. news is available.

Besides, we get huge fun from reading what certain newspaper critics say about B.B.C. programmes.

Which critics ? As one of my landladies used to say: "Wild 'orses wouldn't wring a word from these 'ere lips."

The Die-Hard.

HOWEVER, the imaginary feud dies hard. In Tennessee, U.S.A., there is a "daily" which absolutely bans the use of the word "radio" in a news story, editorial or other article.

It gives not the slightest evidence that it is aware of the existence of the two local radio stations; and if President Roosevelt broadcasts a speech to the entire population of the "sweet land of Lynchery" the paper prints it, but forgets to mention that it was broadcast.

Nothing like a good hater !

The Japanese Again.

THIS time it is Kenya Colony. The import duty on radio goods is 20 per cent *ad valorem*, yet the Japanese are landing four-valve pentode sets (including valves) there at a selling price of £5 17s. Further, they are offering six-valve radiograms for £12, f.o.b. Kobe, and six-valve pentode sets, with valves, for £5 18s., f.o.b. Kobe.

On the same f.o.b. terms they offer a three-valver, with valves, for a guinea ! Quality and performance are unknown to me, but the Japanese can turn out good stuff. Another British market is heading westward because of competition from the East !

There's a Reason.

UNDOUBTEDLY one of the most successful producers of radio revues, etc., is Mr. Ernest Longstaffe, and I have quite recently stumbled upon a fact which goes far to explain the reason why.

In his early days he was tutored by a blind clergyman and learned to develop his senses of touch and hearing more than his sight. Hence he has a kind of genius for composing programmes which appeal without visual effects, and thus he produces work which is particularly suitable for broadcasting.

Putting the "P" in Punch.

ALTHOUGH our radio critics probably exert more influence than the American kind, they certainly do read like flowers in May after one has spent an hour with the New York lads of the pen.

"Time signal for Monarch Corn by a particularly poor announcer. Mush-mouthed and doubtful of diction." Clean on the chin !

Again: "Listening to the stilted and over-affected dialogue is less painful than the high-pitched gibbering of ——." Another to the solar-plexus !

The Time and the Place.

WE see a lot of exciting stuff in the Press these days, all about what is wrong with the B.B.C. I say, "Not much is wrong with the items of the programmes," for, however "dry" some may be, they are bound to tickle somebody to death, and, in fact, the whole B.B.C. effort is to improve us mentally and entertain us cleanly.

But—and here is the catch—the timing and distribution of the items are faulty. And the only way out of the B.B.C.'s difficulty of cramming so much into a day's programmes is real, honest-to-goodness, unadulterated alternative programmes. The present "alternative" layout is a hollow mockery.

His Wounded Pride.

THIS yarn is still current coin in Stock Exchange circles: The radio set in a certain swell London boarding-house was about to deliver the news when an S O S was interjected. Somebody in Packhorse Lane, Bolton, was inquiring for W—— B——, last seen wearing tennis shoes, black trousers, yellow blazer and a postman's hat.

The man in the far corner sprang up with a yelp of surprise. "Bah goom ! They've gotten me ! And I thought yon disguise would mek t'lads all muzzy like. But you can't fool my Lizzie."

Prophesying by Wireless.

THIS is a pretty good one from the "Evening Standard": A victim of sciatica used to undergo treatment by a manipulative surgeon.

On one occasion he called without an appointment, and was surprised to hear the surgeon say that he had expected him, because he (the surgeon) had failed to pick up America on his receiver the previous night, owing to "atmospherics" !

The surgeon believes that atmospherics and sciatic attacks synchronise, and I am not so sure that the theory is as fantastic as it may seem when first encountered.

My Short-Wave Section.

STATION L R 4, Buenos Aires, has been transmitting two one-hour programmes daily on short waves since February 1st, composed of music and Argentine news. These transmissions are actually made by the powerful station at Monte Grande, belonging to the chief wireless telegraph firm in the Argentine, "Trans-radio Internacional." Wavelength, 28·99 metres.

The transmissions intended for Europe take place from 20.00 to 21.00 (G.M.T.), and for America from 01.00 to 02.00 (G.M.T.). There's something to hunt, without the need of staying up late or getting up early.

An Awkward Question.

FROM a reliable source I have heard of a case which ought to take a high place in the annals of ready wit. A man, it is related, bought a wireless set. Very shortly afterwards a reduction in the price of that particular type was announced, whereupon he promptly asked the dealer for a refund.

That would have stumped many of us, but not so the dealer. "If," he replied, "the price had been raised instead of reduced, would you have offered to pay me the extra amount ?" Would you, dear reader ?

A Mix-up in Spain.

A QUEER position exists in Barcelona, owing to the change-over to the Republic and the autonomy of Catalonia. Under the late monarchy Radio Barcelona was erected by a firm which had received a radio monopoly.

There was, however, a small station in the same province—as it was then—a sort of regional station, run experimentally by a group of amateurs.

The Republic came, and later the autonomy of Catalonia. But Radio Barcelona still represents, officially, Madrid. Conceive the annoyance of the Catalans !

The Herring Hunter.

CAPTAIN RONALD BALLS, of the good steam drifter Violet and Rose, had a good year of grace, 1933, amongst the herrings, and told the "Fishing News" so in no uncertain accents. In fact, his enthusiasm for the Marconi "Echometer" grows with every cran of fish which is shot on to Violet's—and Rose's—deck.

The "Echometer," though primarily intended for the rapid taking of soundings, has proved capable of indicating the presence of herring shoals; and well Capt. Balls knows it, for in August, 1933, his average catch for 41 blind "shots" was 4·4 crans, but he got an average of 8·0 crans for 28 shots on "Echometer" indications.

A Really Good Set.

BY the time this gets into print I expect that thousands of you will have tried focused radio for yourselves. And I am confidently anticipating some joyous correspondence on the subject.

As a general rule I let the "P.W." technical hounds enjoy their test-room triumphs alone; but when the "Bifocal Three" was being tested, prior to its publication three weeks ago, I happened to hear the results it gave on the test bench. And, believe me, they were great.

I'm not supposed to know all about decibel gains and logarithmic lift-up, but I *do* know a good set when I hear one.

ARIEL.

THE FREEDOM OF THE AIR!

By LORD STRABOLGI

Our contributor, better known perhaps as Lt.-Commander Kenworthy, has long been a champion of free speech. His distinguished record as a sailor, as a politician, and as an author makes his views all the more worth serious attention. In this article he draws the moral of the recent "Ferrie affair" and compares the attitude of the B.B.C. towards freedom of opinion with that of other countries.

ALL the world has been laughing at the joke of the Ferrie broadcast. Some people are now indignant.

Following a talk by a typical employer in the motor manufacturing industry, a talk was arranged to be given by Mr. Ferrie, expressing the typical workman's point of view. As he is employed in a motor factory and is not active in politics, the choice was suitable.

A Mutilated Manuscript.

But his MS. was so mutilated that Mr. Ferrie refused to deliver the talk, and enjoyed himself for two or three minutes saying so into the "mike," until an astonished B.B.C. official recovered his senses sufficiently to signal the engineers to switch him off. The newspapers rushed for the original MS., and it was printed in full, B.B.C. mutilations and all, in several daily journals: showing once more that the Press is freer than the Radio.

There are several lessons to be learnt from this episode. I, as the holder of a wireless licence and as an Englishman, object to a great national institution like the B.B.C. making a fool of itself. I object also to foreigners having the laugh on us. Still more do I object to any form of domestic censorship over what is to be heard through the ether.

It is desirable to prevent broadcasters saying things unnecessarily offensive to our neighbours in other countries; also to prevent words and expressions of an indecent nature, or which offend against religious sentiment, or are in the nature of personal attacks or libels. These prohibitions are, quite rightly, insisted on by the newspapers themselves. But, apart from these necessary precautions, there should, I submit, be complete freedom. And I believe the overwhelming majority of listeners are of the same opinion.

"I Delight in Argument."

I am a controversialist. I delight in argument and the clash of ideas. Controversy is the salt of life. If everyone was of one mind on every subject we should never progress.

In the newspapers I can say what I like. The editor sometimes adds a short paragraph to the effect that contributors' opinions are not necessarily those of the newspaper. There is no harm in that. The Press allows more freedom of expression than our B.B.C. mandarins. Some newspapers object to certain policies. It is unreasonable to expect a strongly Free Trade paper to print an article lauding tariffs and quotas. But there are other papers which will, and do, present the case for Protection and tariffs.

The B.B.C. is a monopoly. If its chiefs object to a line of policy or argument they can, and do, prevent its expression through the radio.

What is the only sound and logical alternative to a healthy freedom for controversial matter on the wireless? It is official, bureaucratic and complete control. The programmes, on their controversial side, would then be as interesting as the Official Gazette or a Government Blue Book.

There may be something to be said for a complete official control and the banning of all heterodox opinion in broadcasting.

LORD STRABOLGI (Lt.-Commander J. M. Kenworthy.) He entered the Royal Navy in 1902, and saw active service. Later he represented Central Hull as a Liberal, and made a Parliamentary reputation, before joining the Labour Party in 1928.

But there is nothing to be said in favour of the present policy of the Governors of the B.B.C.: for it is neither one thing nor the other. They pretend to be impartial; but they are not.

Presumably the Director of Talks knew what he was doing when he invited Mr. Ferrie to speak. He chose him to give *a* working man's point of view. No one will pretend that Mr. Ferrie, or anyone else, could give *the* working man's point of view; because that differs with the individual. I know many working men who are hidebound Conservatives and as "traditional" in their outlook as any member of the House of Lords. But, having chosen Mr. Ferrie to speak, they should have allowed him to say what he liked.

We Don't Like Spoon-Feeding.

If his views were too "advanced," in the opinion of the B.B.C. Governors, they could have arranged for a later "talk" by someone with opinions more to their liking. Or another employee could have been invited to reply. Man is a reasoning animal.

Our people are adult enough to be able to form their own judgments on the larger questions of the day. What we listeners object to is being spoon-fed by self-appointed pundits who decide what is good for us to hear "on the air."

As for arguments in controversy that may be thought objectionable or derived from what the Japanese police officials call "dangerous thinking," the remedy is to controvert them, if possible, with better logic.

How They Do It Abroad.

A personal experience of my own in the United States of America will illustrate what I mean.

On my last visit, in 1932, the great Columbia Broadcasting System invited me to go "on the air" for a continent-wide "hook-up" as a British politician and author. It was not my first experience of broadcasting on the other side of the Atlantic, for I had spoken to American and Canadian listeners before both from New York and London. (My London talks were relayed by cable and came over the radio on the other side of the Atlantic very well.) And I have always found both the National and Columbia officials most efficient, courteous and helpful. So I accepted readily. "What shall I speak about?" I asked.

"You can talk on any subject you like," was the reply. "Find something topical and of general interest, and it will go over fine."

At that time the Japanese fleet and army were attacking and bombarding Shanghai. The American public were particularly interested, and even indignant, at this breach of treaties and the Kellogg Pact. As a naval officer I served for three years in Chinese and

(*Continued on page* 50.)

RADIO TERMS

A practical review of technical items, specially written for the enthusiastic beginner

By G. V. DOWDING, Associate I.E.E.

MANSBRIDGE CONDENSER.

A large-capacity-type fixed condenser in which the plates comprise long ribbons of tinfoil separated by waxed paper, the whole being wrapped up into compact form.

The disadvantage of a simple application of this method of construction is that considerable inductance (comparatively speaking) may be introduced.

MATCHING.

A term employed to indicate the coupling of a loudspeaker to the output stage of a set in such a way that the maximum undistorted power is obtained.

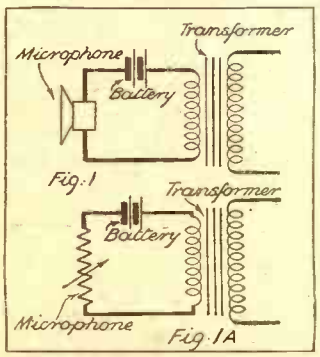
In order to obtain this it is necessary that the output valve's anode circuit should attain a certain impedance, and this varies as with different valves.

In the literature accompanying the majority of power valves the expression "optimum load" occurs, and it is the value of impedance in ohms following this which denotes the impedance which should be introduced into the anode circuit to produce the best working. It might be, for example, 7,000 ohms.

But the impedance of the speech coil of a moving-coil loudspeaker may not exceed five or six ohms, and very poor results would be given were this to be joined directly in the output stage.

Therefore, in order to affect an adjustment, or in other words to provide *matching*, a transformer is employed. (In some cases a tapped choke is used as an auto-transformer.)

MICROPHONE CONNECTIONS



The microphone, shown in connection with its battery and transformer in Fig. 1, has been redrawn in 1A as a variable resistance.

The ratio necessary for the transformer to assume if correct matching is to be obtained can be found by dividing the impedance of the loudspeaker into the optimum load demanded by the valve and taking the square root of this result.

Many modern loudspeakers are fitted with transformers which have alternative terminals for various ratios. In the simplest instance there are three terminals, and the one is used with either of the other two in order approximately to suit either an average pentode or small-power valve.

It should be realised that matching is a vitally important consideration, and that when more than one loudspeaker is used with a set some attempt at an adjustment to preserve matching ought to be made.

When two similar speakers, each having its own input transformer, are joined to a set having an ordinary power-valve output they can be connected in parallel by their "pentode" connections, and this will generally affect an approach to the correct conditions.

MEGOHM.

One million ohms.

MICROAMPERE.

One-millionth of an ampere.

MICROFARAD (Mfd.).

One-millionth of a farad. It is the practical unit of capacity, as the farad is too large for general use.

MICROHENRY (Mh.).

One-millionth of a henry.

MICROPHONE.

This is, in effect, the exact opposite of the loudspeaker, for its purpose is to convert sound waves into electrical impulses.

Two types of microphone are used by the B.B.C. The one is the carbon type, and this is similar in principle to the microphones used on ordinary telephones.

A quantity of carbon granules are placed behind the diaphragm, and as the diaphragm vibrates when sound waves impinge on it, so these granules have a varying pressure imposed on them. In other words, they are squeezed more and less tightly together, and the effect of this is to change their electrical resistance.

The Resistance Varies.

Therefore the microphone circuit shown at Fig. 1 can be redrawn as at Fig. 1a, where the microphone is replaced by a variable-resistance symbol.

From this it will be easy to see that as the resistance of the microphone varies, so the current flow from the battery will rise and fall. These fluctuations are passed on to the external circuit (telephone line or amplifier) via the transformer.

The condenser type of microphone has been dealt with under a separate heading. A third type is one which is not now much used in broadcasting studios, and that is the moving coil. Here the diaphragm is joined to a small coil of wire which has current generated in it when it vibrates within the magnetic field surrounding it.

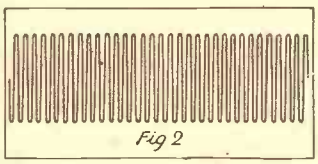
MILLIAMPERE.

Often written as M/a., this is one-thousandth of an ampere.

MODULATION.

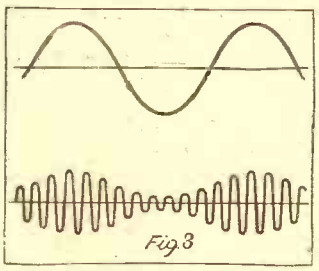
The "carrier"-wave of a broadcasting station is created by a current which oscillates in the aerial of the transmitter at a high frequency. These oscillations determine the wavelength of the transmission.

UNMODULATED H.F.



High-frequency oscillations before they have been modulated with speech or music.

SPEECH SOUNDS



Here is the relatively low frequency of speech sounds and the effect it has on the oscillations of Fig. 2.

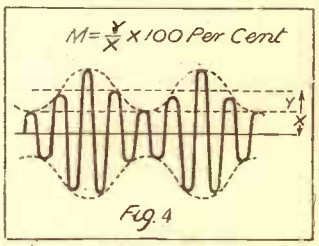
In a 300-metre wave there will be 1,000,000 oscillations per second, for frequency equals velocity (always fixed at 300,000,000 metres per second) divided by wavelength in metres.

These high-frequency oscillations are *modulated* at the low frequencies of the speech and music.

Fig. 2 illustrates an *unmodulated* high frequency. At Fig. 3 is an illustration of a relatively low frequency such as might be met in speech sounds. The pattern of this low-frequency wave form is impressed on the high-frequency current, this latter rising and falling in strength as at Fig. 4, and it is the process involved that is called modulation.

Depth of modulation refers to the extent to which the high-frequency impulses are varied by the low-frequency "envelope." The percentage is arrived at by dividing the amplitude of the "carrier" before modulation into the maximum amplitude assumed by the low frequency and multiplying this by 100.

HOW IT IS DONE



The depth of modulation can be found by dividing Y, the maximum amplitude of the low-frequency voltages, by X, the amplitude of the carrier-wave before modulation. Multiplying this by a hundred gives the percentage modulation.

A broadcasting station can increase its range by increasing its depth of modulation, but 90 per cent is about the maximum employed.

The modulation of a carrier-wave sets up "sidebands" in the ether. These are composed of waves differing in frequency from the carrier by exactly the frequencies of the low-frequency modulations.

Thus a single 1,000-cycle frequency impressed on a 1,000,000-frequency carrier sets up two sideband frequencies, one "plus" and the other "minus," i.e. 1,001,000 and 999,000 cycles.

MORSE CODE.

Combinations of dots and dashes representing figures and letters for telegraphic purposes.

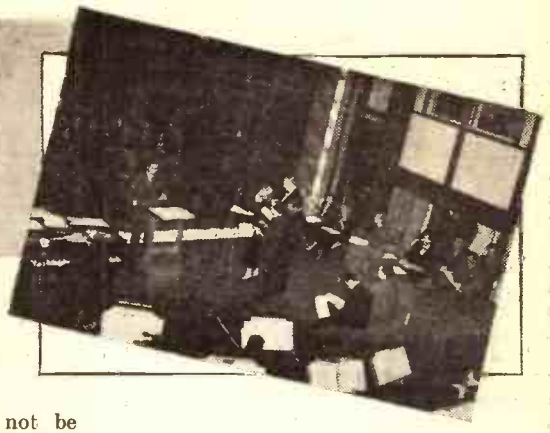
A ·—, B —···, C —·—·, D —··,
E ·, F ··—·, G ——·, H ····,
I ··, J ·———, K —·—,
L ·—··, M ——, N —·, O ———,
P ·——·, Q ——·—, R ·—·,
S ···, T —, U ··—, V ···—,
W ·——, X —··—, Y —·——,
Z ——··, 1 ·————, 2 ··———,
3 ···——, 4 ····—, 5 ·····,
6 —····, 7 ——···, 8 ———··,
9 ————·, 0 —————.

MOTOR-BOATING.

A fault which is so called because of the "pop-pop-pop-pop" noise by which it is often evinced. It is a form of low-frequency instability, and the noise caused may vary in pitch from a slow sequence of "pops" to a howl.

Motor-boating is usually due to an unwanted coupling between two or more anode circuits, perhaps in an H.T. battery (especially when its resistance increases as it runs down) or in a mains unit.

The NEED FOR EXPERIMENT



"Next year," says OUR SPECIAL INVESTIGATOR, "will be critical. Then will be decided the form of broadcasting for a good many years afterwards." The need for experiment and change on the technical side, in the programme department and regarding the licence position is emphasised this week.

THE twin-wave Regional transmitters are now obsolescent.

This is not the fault of the B.B.C. engineers or administration. It is due simply to wavelength congestion. It was impossible to foresee that Great Britain would not secure enough channels to enable the Regional scheme to function as originally planned by P. P. Eckersley.

What will happen as the various "regional Nationals" close down after Droitwich starts? First of all, a good deal of the plant at the transmitters will become redundant. Part of this will be absorbed by the new stations in the North-East of England, North of Scotland and Northern Ireland. But suppose Droitwich does not come up to expectations?

Serious Doubts About Droitwich.

There are already serious doubts in the wireless industry. Authorities there point out that the long wave is under a great disadvantage in crowded centres of population. They fear that the disappearance of the "regional Nationals" will mean that listeners will be deprived of an alternative, being able to get only the normal Regional. If this misgiving is justified, then the B.B.C. will have to think again—and furiously at that. It is fortunate, therefore, that the means of engineering research have been considerably expanded by the purchase of the new property at Balham.

It is not outside the bounds of possibility that the Regional distribution system will have to be recast. It may be necessary to concentrate on three alternative National programmes in an attempt to give the maximum variety to the largest proportion of the listening public. One way of avoiding this abandonment of the valuable ingredient of local interest would flow from successful development of ultra-short and micro-wave working.

Irritating Advertising.

So, in consideration of the future financial arrangements of the B.B.C., it would be premature to attempt to stabilise the amounts to be found for technical requirements and improvements. Provision for capital expenditure for 1934 is revealed in the B.B.C. Report at a figure of £270,000. In the event of a "crisis" about the results of the operation of Droitwich, three times this amount might have to be found for 1935 and 1936.

And yet programmes should not be starved. It would seem, therefore, that an emergency might occur requiring a readjustment of the financial arrangement with the G.P.O. and the Treasury.

Why the B.B.C. does not agitate more actively for more of the licence revenue is a mystery to me. It is not a counsel of prudence to wait for the crisis. The least that should be done is to insist on the Treasury keeping a kind of reserve sinking fund earmarked for emergency capital expenditure on new plant and stations.

If, yielding to Treasury pressure, the B.B.C. continues to look to its publications for additional funds it will be perpetuating an error of potentially serious consequences. The B.B.C. was licensed to conduct broadcasting, and, to achieve this purpose, is protected by a monopoly under Royal Charter. That the B.B.C. should operate one of the most lucrative publishing businesses in the country is certainly not in keeping with the spirit of its constitution.

The B.B.C. falls back on the argument that it is so starved of licence revenue in the present apportionment that it has no alternative to squeezing the maximum out of publications. But consider what is happening in the process.

Large sums are being diverted from private publishers, and the whole publishing industry is so irritated by this State-protected competition that the B.B.C. loses valuable good will.

Also the persistent advertising of B.B.C. journals on the microphone irritates listeners and, in an important sense, violates the spirit of a non-advertising Charter. How can this vicious circle be broken?

Programme Ideas Wanted.

The first step is with the B.B.C., and it should be to prove to the Press its sincere desire to get more licence revenue and to abandon publishing in return for an adequately secured revenue. If this policy were adopted the B.B.C. could look to the future with much greater confidence than at present. Next year will be critical. Then will be decided the form of broadcasting for a good many years afterwards.

I wish I were as happy about programme research as about technical research. There is in the B.B.C. a curious difference of attitude towards these two functions. In technical research Sir John Reith and the Board of Governors seem content to accept the recommendations of the Chief Engineer and his principal assistants. They are allowed to get on with the job in their own way. But in programme work the attitude is different.

I do not say that this reveals any less confidence in individuals concerned. Probably the reason is that it is easier for the layman to understand programme problems. But, whatever the reason, it is certainly true that programme research is not facilitated at Broadcasting House.

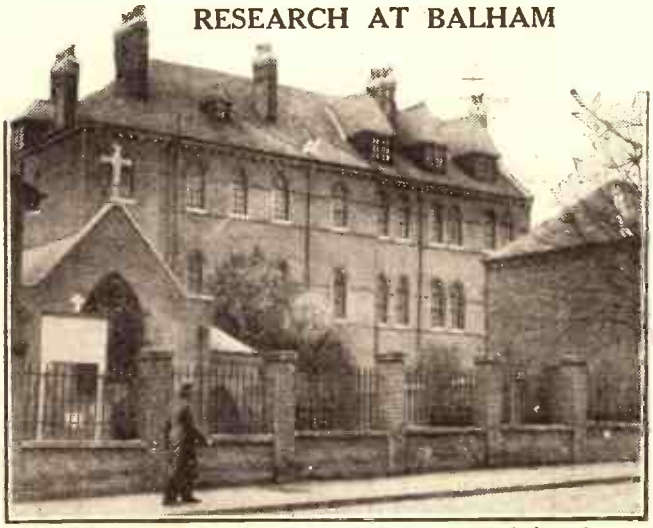
An Effort That Failed.

Some two or three years ago it was decided to appoint several programme officials to devote all their time to experiments in technique, both musical and dramatic. But there was such constant demand for concrete results that the idea was soon abandoned and the experimenters allotted to other work. It was a great pity that this effort was not continued, because it was undoubtedly on the right lines.

A research and experimental department, adequately financed, should be an essential part of the organisation of the Programme Division of the B.B.C. It certainly is of the German and American broadcasting organisations. This department should be divided into three main sections, one dealing with music, another with drama and a third with miscellaneous subjects,

(*Continued on page* 48.)

RESEARCH AT BALHAM



"It is fortunate that the means of engineering research have been considerably expanded by the purchase of the new property (seen above) at Balham."

YOUR NEXT CABINET

By REGINALD TEECE.

IN the cabinet to be described most of the worries of woodwork are overcome. The cabinet follows a modern trend and makes use of an attractive two-colour scheme.

A special feature of this cabinet is the trouble-free corners. These are of American oak and should tone with the ornamental baffle, which could be cut from a piece of plywood of figured oak. Both the corners and the baffle should be polished in their natural state. The rest of the cabinet is stained with black aniline dye, dissolved in methylated spirit, and afterwards polished in the usual manner.

The baffle is not designed on a "square," as is usual with most cabinets, and its depth gives a more pleasant psychological function than would be otherwise the case. While this part serves both purpose and effect, boisterous ornamentation is avoided, which is as it should be. The baffle is glued to the face of the cabinet over the circular speaker aperture.

FIXING THE CORNERS

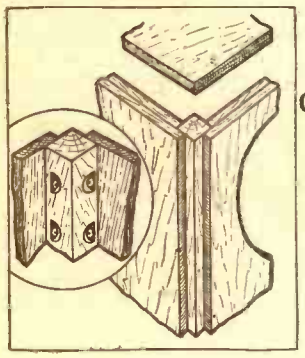


Fig. 1.—Showing how the corner pieces are fixed in relation to the front and sides and how the screwing may be done from the inside of the cabinet for the sake of neatness.

Fig. 1 clearly shows the arrangement of the corners in relation to the front and sides of cabinet. It will be noticed that these can be screwed from the inside of the cabinet if so desired. The method used in this case is termed pocket screwing, and is shown in the small inset. This method of using screws from the inside of a structure is well worth studying, as it can be used in connection with a variety of jobs. The tool used for making the "pocket" is a half-round gouge.

Arranging the Inside.

In Fig. 2 we see the way of arranging the inside of this cabinet. At the top we must screw fillets, as indicated by the parts "F." These are for securing the top of the cabinet, screws being driven through the fillets into the top. An important point to remember in connection with these fillets is to set them slightly lower than the top edges of the sides of the cabinet. This ensures the top being "pulled up close."

The speaker is housed in the top compartment of the cabinet. The shelf "S" is screwed down to fillets arranged inside the case and the base fixed in the same way. The back of the cabinet is quite straightforward, and no details of this part are needed.

When the whole has been assembled the cabinet should be carefully rubbed down with glasspaper, finishing with a fine grade. If the aniline dye is used this should be made strong and applied generously, but evenly, and this will later need to be rubbed down. A good plan is to mix some polish with the dye, which acts as a fixative and facilitates the smoothing process.

A brush can be used for the first coat of polish, and later the rubber. A piece of scrap wood should be kept at hand on which to test the stain as the work proceeds, as no polish must be applied until a definite depth of black has been attained. For each coat of stain applied to the cabinet you can also apply one to the scrap, and at any time during the staining ascertain the effect on this waste piece of wood before you start using polish on the cabinet.

The dye must be strained before use. When staining be very careful that you do not allow the dye to come in contact with the light parts of the cabinet, as it is extremely difficult to remove.

THE TWO PARTS

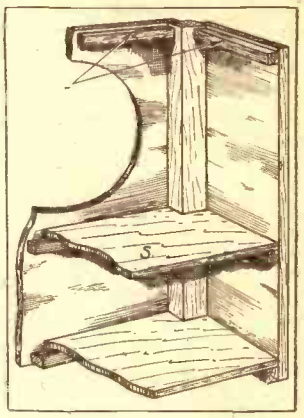


Fig. 2.—This is the method of arranging the inside of the cabinet. Note the fillets (F) at the top. The upper compartment contains the loudspeaker, and the shelf (S) is screwed to fillets, as clearly shown in this drawing.

SPECIAL BEGINNERS' SECTION.

RADIO SUMS SIMPLIFIED

IN our last article on logs. ("P.W." for March 10th) we explained the method of reading a four-figure log. table and also how the characteristic is obtained with the aid of a simple rule.

This rule, which applies only to numbers greater than one (unity), says that the characteristic is always less by one than the number of figures to the left of the decimal point. These characteristics are positive.

But what if the number in question is less than one? In this case the characteristic is *negative* and is denoted by a minus sign thus: $\bar{1}$, $\bar{2}$, $\bar{3}$, etc.

We know (this has been explained in previous articles) that the log. of 10 is 1 and that of 100 is 2. Or, in other words, $10 = 10^1$ and $100 = 10^2$, the log. in each case being the index or power to which the base has to be raised to give the number.

Dealing with Decimals.

Now ·1 is the same as 1/10 and ·01 is identical with 1/100. We can write 1/10 as 10^{-1} and 1/100 as 10^{-2}. Hence the log. of ·1 must be -1 and of ·01 it is -2.

Both -1 and -2 are written in log. language as $\bar{1}$ and $\bar{2}$, and are generally called bar one and bar two.

The logs. of all numbers such as ·1, ·01, ·001 and so on are negative, because these numbers are less than one.

The Negative Characteristic.

The rule by which we determine the characteristic of such numbers states that *the characteristic of a number less than unity is negative and is greater by one than the number of zeros which follow the decimal point.*

Thus the characteristic of ·6132 is $\bar{1}$. If the number is ·0341 the characteristic is $\bar{2}$, and for the number ·0004 the characteristic is $\bar{4}$.

Suppose we want to find the log. of ·8146. Looking up the tables, we discover that the mantissa of 814 is 9106. Then we find the fourth figure (6) in the table of differences.

The number in question is 3, which, added to 9106, gives 9109 as the mantissa of 8146.

The characteristic is $\bar{1}$; hence the log. is $\bar{1}$·9109.

Now there is one more step before we can make a start on the use of logs. in actual practice. In your tables you will find a section devoted to anti-logarithms.

It is no use knowing the log. of a number unless you can also convert the log. back again to the number.

This is where anti-logs. come in. They enable you to find the number represented by a log.

Suppose you are given a log. such as 2·7129 and you want to know what number it represents.

Look up the anti-log. tables and you will discover that 712 is 5152. In the difference column under the fourth figure 9 you will find 11.

Add this to 5152 and you get 5163. From the characteristic, which is 2, you know that the number is positive—i.e. greater than unity. Also, since the characteristic is 2, there must be three figures to the left of the decimal point (this is the whole number part).

Representative Examples.

Therefore the number represented by log. 2·7129 is 516·3.

If the log. had been $\bar{1}$·7129 the number would have been 51·63. Similarly, if the log. had been negative, such as $\bar{1}$·7129, the number would have been ·5163.

COIL CONSTRUCTION

Ensure that your tuning inductances are efficiently designed by bearing in mind the advice given in this article.

I ALWAYS used to be quoting the fact that one of the principal charms of short-wave work was the "home-made" aspect. There was so much that one could build oneself and so few manufacturers who were keen enough on short-wave work to encourage one to do otherwise.

That has changed considerably. One can now buy commercial short-wave receivers, full kits of parts or isolated components with the greatest of ease.

But *still* some of us have an itch to make our own gear. It is not always with the idea of saving money—I have a friend who buys a ten-guinea receiver and then takes a fiendish delight in building one out of junk that will work as well or even better.

A Good Home-wound Type.

Short-wave coils are to be the subject of my notes this week. So many people make their own short-wave coils that a few "don'ts" and, better still, a few "do's" may be of interest.

'Way back in the great "low-loss" era, when we all kidded ourselves that a metal panel within six inches of a coil would ruin the receiver, we used to make marvellous self-supporting coils, *sans* former, *sans* plugs, *sans* everything. Nowadays we buy a coil wound tightly on a rigid former equipped with a hefty two-pin plug, and are perfectly happy about it. I want to start a school midway between these two.

WATCH THE ENDS

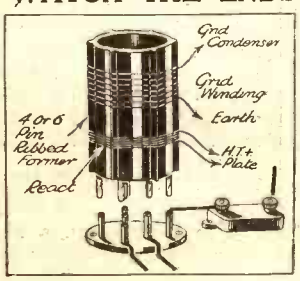


Fig. 1 shows a good type of coil that anyone can make for himself on one of the commercial ribbed formers that one can obtain with either four or six pins.

The most important thing to note is the disposition of the ends of the coils. It doesn't matter in the least which of the pins you take them to, but the wiring in the set *does* matter. What we may call the "free end" of the grid winding *must* go to the grid condenser. Likewise the free end of the reaction winding must go to the plate.

This gives us the two low-potential ends in the middle, a very desirable state. Try to imagine the thing as one long coil, connected to the grid at one end and the plate at the other, with an earth tap somewhere in between—*not* at the centre, by the way.

That will always guide you when you come up against a coil problem. Note, next, that the grid coil is space-wound with fairly stiff wire, but that the reaction coil consists of fine wire and is wound close. The ideal appears to be a small, compact reaction coil, wound with fine wire, but fairly close to the grid coil.

Fig. 2 should guide you when you are making a coil with a smallish number of turns. I have suggested that every other slot should be missed when you wind the grid coil, but that the whole of the reaction coil should keep to one slot, which may, if necessary, be enlarged with a file or a hacksaw.

Fig. 3 shows roughly the disposition of the three windings when a separate aerial coupling coil is used. Note that the reaction coil is still small and close up, but that the aerial coil is much farther away from the grid winding. The aerial coil may often be made "slideable" until the right degree of coupling is determined, after which it can be anchored.

Note, too, that I have depicted a "solid" ebonite former in Fig. 3, just to show that I'm not prejudiced. We are always told, and we generally believe, that ribbed or skeleton formers are almost a necessity for efficient short-wave coil winding, but I must confess that when I have wound coils on solid formers I have never noticed any difference in results. When I say "solid," however, I am thinking of ebonite, and not those nauseous materials that resemble a bad grade of coal!

USING A PLAIN FORMER

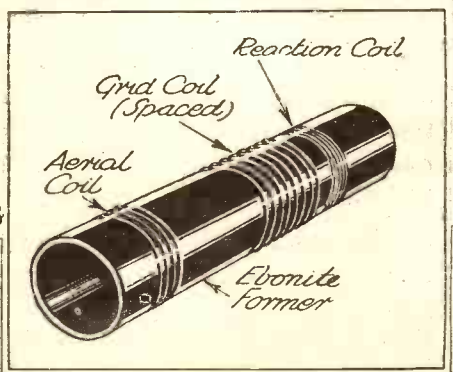


Fig. 1, to the left, shows how the beginning and end of each coil should be connected, while Fig. 2, to the right, indicates a good method of obtaining excellent spacing. The diagram above (Fig. 3) illustrates that loose aerial coupling may be obtained even when using a single former for all windings.

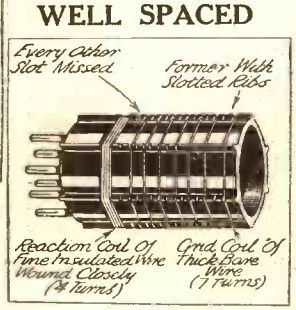
How Many Turns?

Don't take risks with solid formers of unknown materials. Ebonite, good bakelite and some grades of paxolin are above reproach, but there *are* substances which have quite a high conductivity, even on D.C., which are sold for formers.

Turn numbers are a subject on their own. I could write two whole pages about them. Suffice it to say, for the present, that with the usual 2¼-in. or 2-in. former you will want three coils. I suggest the following sizes:

Coil A should have 10 turns grid and 6 reaction; Coil B should have 6 turns grid and 4 reaction; while Coil C has 4 turns grid and 4 reaction. These three will cover, between them, the range of roughly 16–60 metres. If you want to go lower and higher, just make what coils you think fit.

WELL SPACED


Every Other Slot Missed
Former With Slotted Ribs
Reaction Coil Of Fine Insulated Wire Wound Closely (6 Turns)
Grid Coil Of Thick Bare Wire (7 Turns)

An aerial coil of the Fig. 3 variety should have about 5 turns for coils A and B and possibly 3 turns for coil C and anything smaller.

Ingenious readers will be able to make up four-pin coils, arranging a separate aerial coil, perhaps on a swinging bracket to give variable coupling. In that case 5 turns will probably suffice for all wavelengths. I use that scheme myself and never change my aerial coil—not between 10 and 100 metres—but I frequently have to vary the coupling.

On the Short Waves—(*Contd. from previous page.*)

WHAT READERS ARE SAYING

I AM finding it well-nigh impossible to keep up to date with readers' correspondence, so voluminous is it becoming. This week, therefore, I want to deal with the more interesting letters in very much abridged form.

H. J. B. (Manchester), like several others, finds the amateur telephony in the 21-metre band very interesting. The American "hams" using telephony are becoming quite numerous nowadays. W 2 G O Q, of course, comes in for his share of comment, but since he is a pukka broadcasting station we can't be surprised.

H. J. B. finds that W 3 X A L is lasting quite late in the evening now. (I refer to his 16·87-metre wave.) A few evenings back I heard him as late as 8 p.m., and when the American amateurs fade out the South Americans begin. Summer is coming!

What Station Is It?

R. W. R. (Southport) sends in a useful log of amateurs and inquires about X Z L 5 F. I have heard several Americans working with this man, but have never happened to hear him yet. His call-sign looks like a New Zealand portable!

W. H. R. (Plymouth) sends in a beautiful list of stations heard since last August, and promises to write regularly with news. Knowing his extraordinary capacity for picking up interesting tit-bits, I think this should be very nice for all of us!

R. D. E. (Ware) claims reception of Poona (V W Y) and Shanghai (X G R). He also says that the R.A.F. call-signs that a reader mentioned recently can be heard on 21 and 16 metres as well as 60. (It can't be 21, R. D. E.—that's the amateur band.) He wants identification of R K F, Moscow. Can anyone oblige?

D. R. C. (Eastleigh), in the course of an interesting letter, mentions that he seems to be in a very good spot for Australia, but the "Yanks" suffer in consequence. That would appear to be the opposite of my own situation, which is abnormally good for Americans and very poor for Asia and Australia.

The Forbidden Call.

Several readers write in to say that they have been receiving telephony from K 4 S A. This is, of course, an amateur station in Porto Rico. He has been coming in well for several evenings on the 21-metre band.

H. E. G. (N.15) protests about an unnamed amateur who does nothing but call C Q. If he is a Britisher (not a pirate) he will soon find his career brought to an untimely end, for C Q is absolutely forbidden by the G.P.O. regulations.

J. H. A. J. (Wimbledon Park) reports very consistent reception of Sydney on Sunday mornings during *last* winter, but several disappointments this season, until he finally found him during a Sunday afternoon instead. Among other things he comments on the enormous strength, on occasions, of W 8 X K on his 19·72-metre wave nowadays. I've noticed that, too!

W. W. (Exeter) has received a "veri" from the La Paz station, C P 5. They are apparently on daily on 49·30 metres from 00.30 to 03.30 G.M.T.

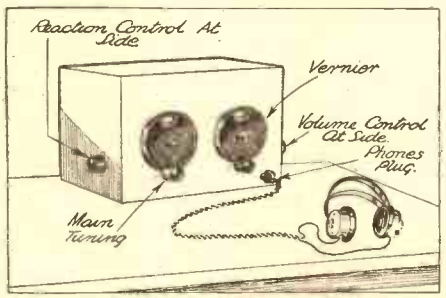
F W. (Plymouth) suffers from severe hand-capacity troubles, and apparently nothing he does will cure them. He inquires, more in sorrow than in anger: "Why is it that some people can build a short-waver out of junk from the dustbin and bend their moving vanes without losing signals, while poor me . . . ?"

Although it sounds highly improbable, I am prepared to believe that some people *are* haunted by hand-capacity effects. I once met a man who couldn't operate my own beloved set without losing signals! Whether it's "bodily magnetism" or something unusually attractive (or repulsive) about such people, I don't know.

Unfortunately, I can't help F W., for he assures me that he has already put into practice every single hint that I have ever given on the subject.

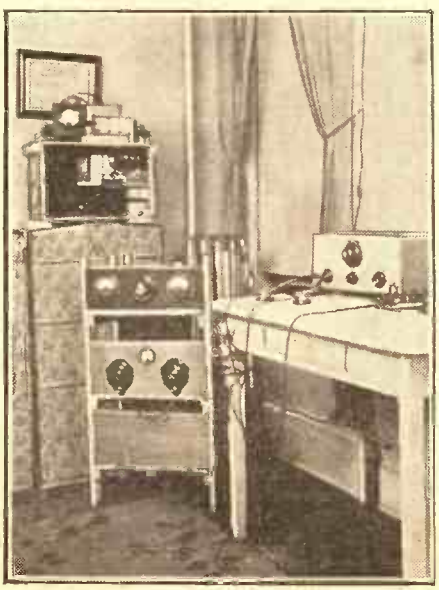
The faithful J. B. M. (Glasgow), whose cards and letters liven (and enlarge) my post-basket, forwards to me a description of W 8 X A L, W L W and W 8 X O, all of Cincinnati, Ohio. W 8 X O, of course, is the notorious 500-kw. station operating on the medium-wave broadcast band. An 831-feet aerial mast and 500 kw. *should* make a fair-sized hole in the ether.

FOR EASE OF HANDLING



W. L. S. recommends this unusual arrangement of controls for comfort when tuning. The reaction and volume controls are arranged at the ends of the cabinet, leaving the panel free for the tuning dials.

AN AMERICAN STATION



This neatly arranged transmitter and receiver constitute the apparatus at the American amateur station, W 2 C F V. The transmitter itself is a crystal-controlled 100-watt outfit.

I AM asked to inform readers that the Anglo-American Radio and Television Society, which is not unconnected with short-wave work, is forming a new branch in Leigh, Lancs. Anyone in the district who is interested is asked to apply for further particulars to Mr. Harold Hughes, 64, Siddow Common, Leigh, Lancs.

A Few S.W. Clubs.

Incidentally, readers interested in short-wave clubs might appreciate the following list of addresses, for which I have been asked by several correspondents: Radio Society of Great Britain, 53, Victoria Street, London, S.W.1; the International Short-Wave Club, Klondyke, Ohio (London address, A. E. Bear, 10, St. Mary's Place, Rotherhithe, S.E.16).

The International DX-ers' Alliance: British address, R. L. Rawles, Blackwater Corner, Newport, I.O.W.; Anglo-American Radio and Television Society (mentioned above): London address, L. W. Orton, Kingsthorpe, Willowbank, Uxbridge.

To my knowledge several readers of "P.W." have been instrumental in starting small, informal short-wave clubs in their own neighbourhoods. Will members of any such clubs or societies please notify me of their existence so that I can keep a check on them? I often receive letters asking whether there is any such organisation in a man's home town.

Five Metres to the Fore.

As an example, I might mention the South London and District Radio Transmitters' Society. In spite of its fearsome title, this society has a large number of "receiving" members who are catered for just as much as the transmitters. So that I may keep track of them all: Secretaries, forward, please!

"Australian Radio News" intimates that there is going to be considerable 5-metre activity out there in the near future. On this subject will anyone considering doing anything in this line over here please let me know what's in the air?

I have a shrewd suspicion that 5-metre work is going to occupy quite a lot of space in "Short-Wave News" this summer.

The Budapest Relay Transmitter.

Readers who have reported an unknown (or, in some cases, a known) station on 44 metres, apparently relaying medium-wave programmes, may be interested to know that it is Budapest, and that he is likely to be working with greatly increased power in the near future.

A reader who does a lot of late-at-night and early-in-the-morning reception has promised to let me have, as nearly as possible, a correct schedule of the various Colombian stations, who are, at present, extremely irregular.

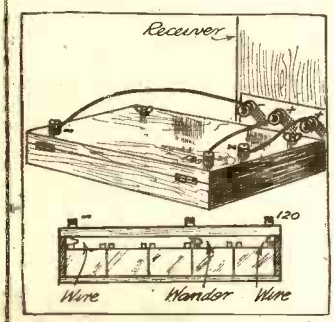
W. L. S.

Recommended WRINKLES

A NEAT BATTERY BOX.

A FRIEND of mine has wet high-tension batteries in a box. She asked me to clean and re-top the acid for her. While doing this it struck me that much time and labour would be saved if I made a lid and hinged it to the side.

Two holes were bored at two of the corners to take two screws which hold two wing nuts. Three terminals—



The cells are kept clean and accidental shorts avoided by "boxing" the H.T. battery.

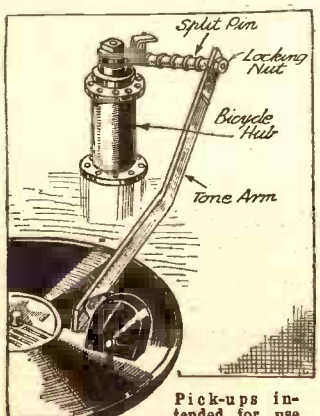
one negative, and two positive, as shown in the above sketch—were then screwed in the lid to fit over the original terminals of the batteries.

Wires were then connected to each position as marked. The lid was screwed down and the terminals on the set brought down to the terminals on the lid, keeping the cells clean and dust-proof, and also protected against short circuits by anything falling on them.

PICK-UP MOUNTING.

MANY readers possess pick-ups for attaching to existing gramophone arms. These do not always give correct tracking, neither can they be balanced. The accompanying sketch shows a simple arm for such a pick-up.

A front-wheel bicycle hub is used, on the spindle of which is slipped a $\frac{1}{8}$-in. screwed split pin. Over this is slipped a ferrule, and the split pin is opened slightly at the end to lock



Pick-ups intended for use on acoustic gramophone arms can be used on their own in this way.

the nut and yet give free play to the arm.

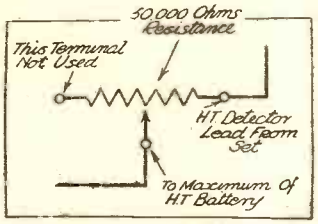
The arm consists of $\frac{1}{2}$-in. x $\frac{1}{4}$-in. metal strip bent to give correct tracking; this will also lift for needle changing. A bent piece of similar metal is fitted over the hub spindle to adjust a spring slipped over the ferrule and taken under the arm to give correct balance.

The pick-up is fixed to the end of the arm with the holes used for fixing the tone-arm ferrule. A hole is drilled in the baseboard and the hub screwed down by the spoke holes.

VARIABLE DETECTOR VOLTAGE.

THIS "wrinkle" is easily applied to the detector-L.F. type of set, which usually has two H.T. + tappings; generally the detector tapping is taken to about 60 or so volts. This causes an uneven drain on the battery.

Some sets have a fixed resistance inserted in the detector H.T. lead,



An uneven drain on the H.T. battery in a det., L.F. set can be avoided by the method shown here.

which is then joined to maximum H.T.

I find a variable resistance of 50,000 ohms better, as it saves the time and expense of experimenting in order to obtain the best voltage drop. Being variable, one is able to compensate when the H.T. battery goes down. It also provides smooth reaction control by the detector obtaining its correct voltage.

The 50,000-ohm resistance may be of the volume-control type, one end terminal not being used. It can be fitted externally or on the set's panel.

A CLASS B TIP.

IF your Class B valve noticeably distorts, as many of them do on the higher notes (particularly with piano music), try a small *positive* bias, instead of the usual zero bias, on the Class B valve. This can be accomplished in two ways: (1) By connecting the centre (secondary) terminal of the driver transformer, *not* to L.T. negative, but to L.T. *positive*; (2) by connecting the G.B. positive lead to 1½ volts negative and taking a lead from the centre terminal of the driver transformer to "plus" on the grid-bias battery.

With the former method (which is employed by Messrs. Ferranti, Ltd., in their "Band Pass Four Class B Constructor's Set"—and to whom I gratefully acknowledge my indebtedness for the idea) the positive bias equals the working voltage of the accumulator (approximately two volts), while with the latter (provided the G.B. battery is fresh) 1½ volts positive bias will be applied.

Positive bias will, of course, increase the standing current of the Class B valve by from three to five milliamperes, according to the H.T. voltage available, but the tremendous improvement in tone amply justifies this little extravagance when first-rate quality is desired.

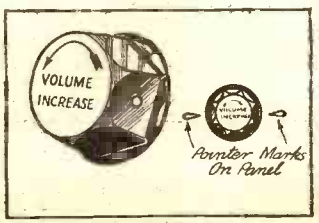
LABELLING PANELS AND KNOBS.

A VERY effective method of permanently marking panels or knobs on wireless sets is as follows:

Where the knob needs marking—i.e. "Volume Increase" or "Volume Reduce," with an arrow to show direction of rotation—take a circle of white paper which will just cover the flat on the knob. On this, if large enough, type—if not, print with marking ink—the required lettering.

When dry, gum on the knob, so that it can be read when the knob is at its normal position. Again, when perfectly dry, smear a coating of Rawlplug Durofix, sold in tubes, over same.

This leaves a durable transparent coat on the lettering, which can be cleaned with a damp cloth, and the label is easily removed at a later day,



Try marking knobs in this way. Panels may be similarly labelled.

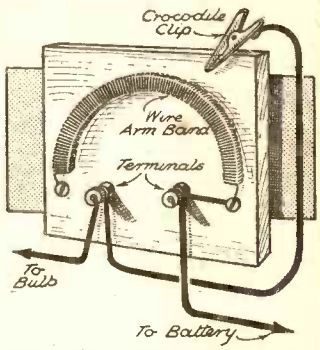
if necessary, with emery cloth or a fine file.

The same procedure can be used for panels.

FOR YOUR DIAL LIGHT.

A SIMPLE "dimmer" for a dial light may be made in the following manner:

Get a wire arm-band and fasten it to a small wooden baseboard. Join one side of the battery to the arm-band and the other side to a bulb holder.



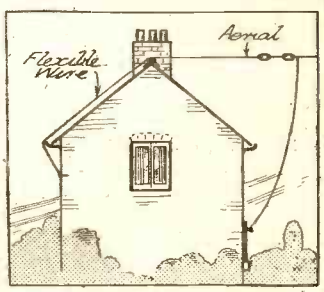
An ordinary spring arm-band is brought into service for this ingenious dimmer.

Another lead is then connected to the lamp, to which a crocodile clip is fastened. By moving the clip the light can be dimmed.

ERECTING AN AERIAL.

THIS is to most of us quite a formidable job, especially the end that attaches to the house. One has either to employ a craftsman at considerable expense or to borrow or rent ladders, etc., and prevail on some kind friend to do the needful on the roof or chimney.

Now this can all be cut out by the following method: Procure a length of cord or string long enough to reach over house and down side; also length



Running the aerial fixing wire over the roof obviates the use of ladders.

of flexible wire to reach over roof and down side. Attach a ball or piece of wood to cord and throw this over roof and down other side of house. To other end of cord attach one end of wire; other end of wire to heel of aerial through usual insulators.

Now, from other side of house, pull over wire to the desired position by means of cord. When in position attach end of wire to nail driven in woodwork of upstair window, or other suitable anchorage. Adjust aerial, and the job is done. The arrangement is quite simple, and should not take more than ten minutes to fix.

ONE GUINEA FOR THE BEST WRINKLE!

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 1s. will be paid for the best Wrinkle from a reader, and others published will be paid for at our usual rates.

Each hint must be on a separate sheet of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that the payment for published hints is not made until ten days after they appear?

The best Wrinkle in the issue dated March 17th was sent by Mr. J. Barlow, Jun., 10, Mellor Grove, Old Trafford, Manchester, to whom a guinea has been awarded.

THE MIRROR OF THE B.B.C.

ALARM AT THE BIG HOUSE

Canada's Regular Relays—The "English Character" Incident—A Change in Announcers?—More Football Commentaries Wanted.

REFLECTIONS BY O. H. M.

PRESS revelations and attacks seem to have stirred things up at Portland Place, the headquarters of the B.B.C. Although it is a much-vaunted policy of the B.B.C. to ignore the kind of Press criticism that it does not like, there is no doubt that on the recent occasion attacks were seriously studied. There is one thing on which the B.B.C. need have no doubt, and that is that these attacks will recur with greater violence and on an ever-widening front until such time as the authorities agree to humanise the service and to take the public into their confidence.

Sir John Reith Gets About.

Sir John Reith is travelling much more than he did. He has just been attending the B.B.C. Staff Ball in Manchester. A few weeks ago he went to a similar function in Belfast. This may represent a changed attitude, and if so it will be welcome everywhere in the B.B.C.

Those Empire Programmes.

There is much discussion at Broadcasting House on the subject of the quality and extent of the short-wave service to the Empire. The Canadian Radio Commission has been trying to arrange, through the Canadian Marconi Company, for a regular daily service of B.B.C. programmes. There have been some hitches at both ends, and it is not known yet whether the experiment will be prolonged.

The Famous Mr. Ferrie.

Mr. Ferrie, the now-famous working man who created a scene at the microphone instead of broadcasting his talk in the series on the "English Character," is stated to have been found for the B.B.C. by Professor Levy and Professor Laski, of the London School of Economics. The incident has embarrassed a number of people at Broadcasting House.

Colonel Alan Dawnay is supposed to have been appointed primarily to keep the talks clear of left-wing propaganda, or, for that matter, of propaganda of any kind. Although, on this occasion, the broadcast was not given, many people are naturally very curious that the negotiations with Mr. Ferrie should have been going on so long without the B.B.C. realising his attitude.

Women Announcers.

Mrs. Agnes Hamilton is reported as being particularly keen on introducing several women into the ranks of the regular announcers. If Mrs. Hamilton's suggestion is adopted—and she has a way of getting things through—married women will be barred.

Good Friday at Midgley.

The Good Friday programmes for the North Region will include a performance of the "Pace Egg," or "St. George's Annual Play," which for the first time will be relayed from the streets of Midgley, a village in the Pennines not far from Halifax.

Two years ago the play was broadcast from the Leeds studios, and this led to its revival in Midgley in the following year.

Until the war this historic play had been performed in the village for at least a hundred and twenty years by adults, but the broadcast will be given by scholars of the local council school.

Mixed Plays for Midlands.

Martyn Webster, the irrepressible producer for the Midlands, is putting on three studio plays—a fantasy, an historical romance and a treasure island tragedy—on Wednesday, March 28th.

TELEVISION HEADQUARTERS

Nothing but a neat **BRITISH BROADCASTING CORPORATION** notice above the doorway shows the passer-by that the B.B.C. Television staff has now taken possession of its new studios at 16, Portland Place—opposite Broadcasting House.

The first, called "The Dream Stone," by Eric Lyall, is the story of a pierrot, the mayor of a Midland manufacturing island and his daughter. The second, called "The Decoy," by Donald A. Robertson, is founded on a legend that Prince Charlie had a "double" who made possible his escape after Culloden by leading the king's troopers astray, for which he forfeited his life.

The third, called "Brains," by Martin Flavin, has for its story the exploits of a party which has a plan of a South Sea island where treasure has been buried, and a skipper, cunning as they make 'em, with whom they bargain for their passage.

A Soccer Interview.

Association football has still very little space in the broadcast programmes, and although, so far as is known, the usual running commentary on the Final tie at Wembley Stadium in April is "O.K." at the moment, it seems a pity that nothing has been done to clear up the difficulties which prevent listeners enjoying descriptions of even parts of the League games that are fought out every Saturday.

Meanwhile, those in control of the game and of the clubs can have no grouse against the B.B.C. for withholding such assistance as it can give to maintain interest in the national winter pastime.

An instance of this will occur on Tuesday, March 27th, when Robert Tredinnick will interview two famous footballers before the Midland Regional microphone.

Capped for England at Nineteen!

One is Mr. Billy Bassett, the chairman of the directors of West Bromwich Albion club, and the other is T. W. Glidden, who has captained the Albion team for the past four seasons. Mr. Bassett was a member of the Albion team which won the English Cup in the 1887-88 season, and he was only nineteen years of age when he was chosen to play for England.

Glidden first played for the Albion in 1921, and during his first year as captain the club again won the English Cup and also secured promotion from the Second to the First Division of the English League.

The broadcast should provide an interesting comparison between the ways in which the game was played in Mr. Bassett's days and as it is at the present time.

THE LISTENER'S NOTEBOOK

Comment and Criticism on Programmes and Personalities.

I'VE come to the conclusion that "In Town To-night" is a frost. The scarcity of celebrities before the mike on these occasions almost suggests that London of a Saturday night is a city of desolation.

For instance, in one of the most recent of the series, the management fell back on a very mixed bag, which included a century-old musical-box and a few words from *outside* London, by Neville Stack, the airman. Mr. Stack came to the microphone from testing a machine in which he hopes to dictate a book while flying.

* * *

Mayor Jimmy Walker redeemed the half-hour. He seemed anxious to say more. But his three minutes were soon up. Why wasn't he given the whole thirty minutes? We would all of us have been pleased then.

These half-hours have been gradually getting worse. Why, I don't know, for the idea behind "In Town To-night" is one of the best conceived and, I would have thought, one of the easiest to develop.

* * *

Why is it that Music-Hall can always give points to Variety? There's something in a name after all, it seems. Some variety hours would never keep me in. Music-Hall invariably would, and does.

There's no doubt about the popularity of the Eight Step Sisters—with the St. George's audiences. I am still convinced, however, that they have no legitimate place in a broadcast bill. They always afford me an opportunity to relax my attention a bit or to stretch my legs.

* * *

On what grounds does Henry Hall consider his experiment with his anti-crooners a failure? Letters, I suppose; but what about that audience at St. George's Hall? Surely he can't ignore such testimony.

I would like to see him give the experiment an extended trial. I hardly like to say this, but I don't think all his anti-crooners were the best he could have got for such a vital experiment.

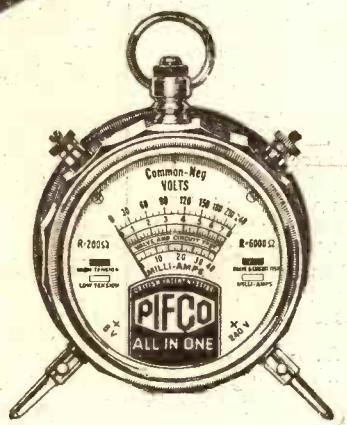
* *

Mr. Val Gielgud's invitation to listeners to air their views on their likes and dislikes of radio drama is a welcome one. There's certain to have been a big response to his request for letters, and I hope the result will be made known and the wishes of the majority be acceded to. Naturally there will be a diversity of requests. The history minded will demand more history, the realistically minded more realism, and the fanciful more fancy.

(*Continued on page* 50.)

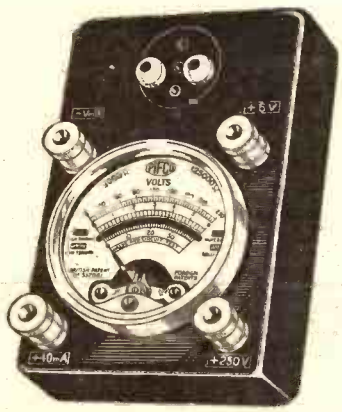
IF your set ought to get Rome – but nearly expires bringing in the local Regional

don't be puzzled find out why



The reason for this lack of ambition may be due to weak valves, run down accumulator or any other cause. Whatever it is—you'll soon find out with a Pifco Trouble Tracker. Every component in radio can be tested quickly and surely by these wonder instruments. Don't endure faulty reception any longer. If trouble starts—solve the problem immediately with a Pifco Trouble Tracker.

Ask your dealer or electrician for a demonstration of a Pifco.



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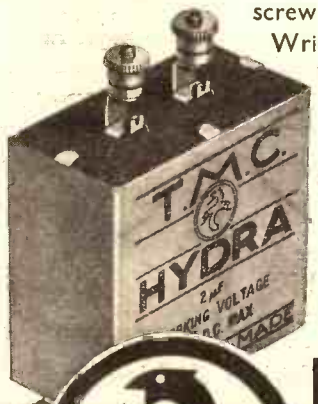

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"I want you, if you will," says our Chief Radio Consultant, "to take two serious and difficult articles from me and pay me the compliment of reading them rather carefully." The subject of P. P. Eckersley's discussion is the possibility of building a receiver perfect alike in selectivity and quality.

"I WANT to build a receiver, regardless of cost, which will give adequate selectivity and sensitivity and perfect quality. I am not content to listen to the local station; in fact, I am most interested in German programmes. Money is no object, but nothing that I have tried on the commercial market has satisfied me Can you tell me what I should do?"

Suppose you had a letter like that, what would you reply?

I should find some difficulty, but I think I would begin with certain tentative probes to uncover a little of the facts, and then proceed according to what I found.

"Regardless of cost" gives me great freedom, but freedom is often a very embarrassing gift. The writer wants to listen foreign, but he cannot get "perfect quality" *and* selectivity. That's old ground between us, and I won't labour that any more.

Well Worth Studying.

Now, as the whole problem set out above is of fundamental importance and interest, I want you, if you will, to take two serious and difficult articles from me and pay me the compliment of reading them rather carefully, because, if you do, you are helping things in two ways: first, you will be able to enjoy your hobby more because you will understand its fundamentals better; second, you will, by the possession of a point of view, possibly be able to influence the trend of affairs for the better. You may, indirectly, secure greater advantages, if not for the listener of to-day, at any rate for the listener of the future.

You must not be bored with me if I go to first principles at first, because it is worth while understanding them; not understanding them means not understanding anything else, and much less being able to advance our knowledge.

I published all that follows about a year ago, but it has either not been understood or, if understood, not acted upon, because technical people are no longer able to influence broadcasting policy—national or international.

Now for it.

You know that when a carrier-wave is modulated we create sidebands. If we transmit on a carrier-frequency of f kilocycles per second, then when we transmit a programme we send out a band of frequencies (all points of the band being in succession or simultaneously full of energy), f + 10* and f − 10 kilocycles/second* wide.

The Question of Sideband Intensity.

We can draw a little picture to show this. In Fig. 1 I have done so. But my picture shows that the sidebands are not all of the same intensity.

The modulations of up to about 1,500 cycles/second are much stronger than those, say, between 3,000 and 4,000 cycles/second. There is a steady weakening of sideband strength as the sideband frequency gets greater or less, i.e. as the modulation frequency gets greater.

Why is it fair to draw the picture like this? Why are the "outer" sidebands much weaker than the inner ones? Answer: "It *is* so, apparently." I have measured the "spectrum of a broadcasting station" (which is tantamount, by and large, to measuring the spectrum of audible sound), and have found it to be like I have shown it in Fig. 1.

It is the job of the receiver to reproduce, first at high frequency, in the high-frequency circuits, *all* the sideband frequencies f + 10 and f − 10, then, after rectification, to pass on all the frequencies, say 50 up to 10,000 cycles/second (a *practical* upper limit), to the loudspeaker.

* This figure is somewhat arbitrary, but it suffices. Really we should go up to 15 or even 18 kc./sec. but 10 would give very good quality.

Now let us look at Fig. 2. Fig. 2 is going to show us that a receiver cannot do this because + or − 9 kc./sec. away in frequency there are other stations perhaps just as strong, maybe stronger, or, on the other hand, if the wanted station is near by, weaker, which in any and every case push their sidebands into the territory occupied by wanted-station sidebands.

Whatever you may say about demodulation, whatever the mysteries attempted to be propounded by the romantics of technology, who love denying first principles, you cannot make a receiver to discriminate between unwanted and wanted sidebands when they have coincidental frequencies. No, sir!

A Simple Illustration.

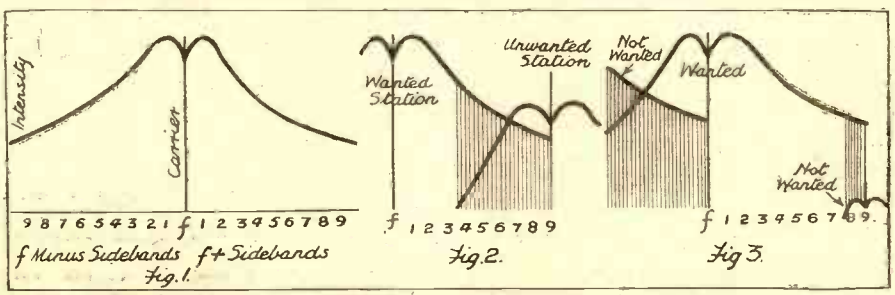
Here it is, as plain as the nose on your face: The technical committee of the Union Internationale de Radiodiffusion, and all that, has *arranged* for the stations to overlap. You will see that with a 20-kc./sec. separation the station sidebands would not overlap, and you could then "separate" stations and still embrace all their sidebands (up to 10 kc./sec.).

But in Fig. 3 I have shown a hypothetical case where, in spite of a 9-kc./sec. separation, one unwanted station is so weak that you cannot hear it. (After all, powerful stations in the U.S.A. use the same carrier wavelengths as we do, but they are too weak to interfere.) Fig. 3 might represent a strongish local wanted station, a very powerful "at-night" signal from a powerful distant station, and as the other unwanted, a far-away weak station.

Now notice that one set of sidebands of the wanted station is not sensibly interfered with. So if we could get a receiver to embrace only one set of sidebands—i.e. be responsive to, say, f + 8 kc./sec. or f − 8 kc./sec., not f + and − 8 kc./sec., we should be much nearer perfection.

Such a receiver would have a better chance of attaining the ideal if it was only concerned with one set of sidebands of the wanted station, because there is less *chance* of these being messed up.

HOW UNWANTED STATIONS AFFECT RECEPTION


Intensity
Carrier
9 8 7 6 5 4 3 2 1 f 1 2 3 4 5 6 7 8 9
f Minus Sidebands f+ Sidebands
Fig. 1.
Wanted Station
Unwanted Station
f 1 2 3 4 5 6 7 8 9
Fig. 2.
Not Wanted
Wanted
Not Wanted
f 1 2 3 4 5 6 7 8 9
Fig 3.

Three diagrams illustrating (1) a modulated carrier with sidebands of gradually decreasing intensity; (2) an unwanted station, 9 kilocycles away, whose sidebands interfere with the wanted station's sidebands; and (3) a wanted station which is interfered with on one side by a powerful unwanted station, 9 kcs. away, but not interfered with by another station, still only 9 kcs. away, but too weak to cause trouble.

HOW TO MAKE an ULTRA-EFFICIENT WAVE-TRAP

In response to an insistent demand from readers we have pleasure in presenting this week a simple and up-to-date medium-wave version of that most famous and successful of all selectivity devices—the Brookmans Rejector. Designed and described by the "P.W." Research Dept.

HARDLY a set that was made a few years ago is sufficiently selective for modern conditions. So many new stations have been packed into the crowded European ether, and so many stations have increased their power, that there are even modern sets which are unable to sort out the programmes cleanly.

And, judging by our correspondence, it is quite obvious that a large number of listeners regard a background of interference from another station, other than the one that is being listened to, as being quite inevitable and unavoidable.

What, if anything, is offered to combat this annoyance?

Gain Instead of Loss.

Curiously enough, a wonderfully effective method seems to have been badly neglected. Instead, all kinds of what must be termed "losser" systems are suggested.

These manage to provide something of a palliative by reducing the efficiency of the set. You know the sort of thing: shorten the aerial to hat-pin dimensions, reduce its pick-up by means of minute series capacities and so on.

Presumably the wide use of such drastic measures is the result of the vastly more sensitive apparatus that can be built. Some present-day receivers do not need good aerials. When they have them all the heterodynes and mush of the chaotic European ether are brought in.

Certainly such sets can well stand a big sensitivity reduction. But there are all those tens of thousands of other sets of more modest character which will not stand such treatment, and to impose a "losser" method of station separation on them is to discard a number of wanted programmes and to reduce the volume of the remainder.

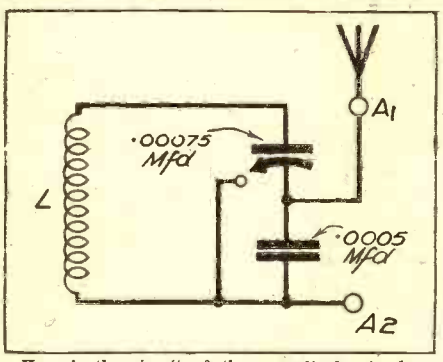
Now, a good wave-trap will absorb a powerful interfering station without to any extent reducing the sensitivity of a receiver.

THE MATERIALS NEEDED

1 Telsen ·00075-mfd. solid dielectric variable condenser, type W.191.
1 Dubilier ·0005-mfd. fixed condenser, type 670.
2 Bulgin indicating terminals (or Clix, Belling & Lee).
1 Paxolin or cardboard tube, 3 in. diameter and 2⅜ in. long.
1 oz. 28-gauge D.C.C. copper wire.
Screws, tag, wood, etc.

And such a device is very simple to build and use and costs only a shilling or two. If the trap incorporates the famous "P.W." Brookmans principle it will actually improve the general selectivity of the set and, in certain circumstances, may even increase its power.

ONLY THREE COMPONENTS



Here is the circuit of the exceedingly simple unit, which is connected externally to the set and in series with the aerial lead.

It is impossible to say how this almost magical effect is achieved. Anyone who knows a little about the theory of radio can see right away that a wave-trap designed in accordance with the "P.W." principle must, in many instances, effect an all-round improvement, besides most effectively silencing any one powerful station.

But the reason for the very considerable fillip it often provides to any other station, distant or near, is still a mystery.

Now, we have indicated that the wave-trap we are describing can be built at little expense and with little trouble by anyone. Nevertheless, it must not be forgotten that the Brookmans principle imposes definite design restrictions.

You must use only those components mentioned in our list and only that type of coil which we are about to describe. Otherwise we cannot guarantee that the device will operate with the extraordinary effectiveness of which it is capable.

However, it will, we hope, be agreed that it isn't asking much when we request constructors to copy our design closely.

The foundation of the trap is a Paxolin former, 3 in. in diameter and 2⅜ in. long. The two terminals are to be mounted at opposite sides of this former, 1½ in. from the one end. The winding starts from the same end from which that measurement is taken, and it begins at about 3-16ths of an inch from that end.

Winding the Coil.

The wire is anchored by threading it through two small holes pierced in the former by a gimlet or other sharp instrument. Leave at least 3 in. of wire for connecting purposes.

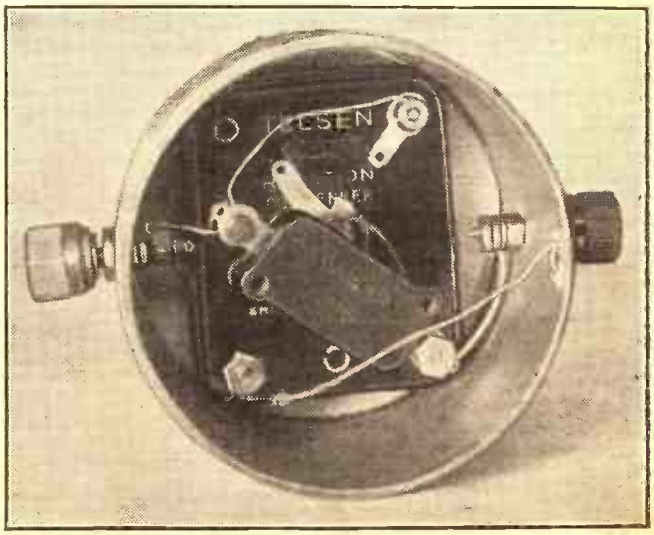
The winding comprises 45 turns, and it does not matter in which direction it is wound.

It is finished off at the other end in the same way as it was anchored at the beginning, but you won't have to leave 3 in. over, because it connects straight to the terminal which is placed just where it concludes.

The small variable condenser used in our

(*Continued on next page.*)

LOOKING INTO THE COIL FORMER



The fixed and variable condensers are attached to the piece of wood that is fitted to the top of the former on which the coil is wound.

HOW TO MAKE AN ULTRA-EFFICIENT WAVE-TRAP

(Continued from previous page.)

original model incorporates a self-shorting scheme. This is a quite optional refinement; it enables the trap to be shorted out of action, when desired, without it being necessary to touch its terminal connections.

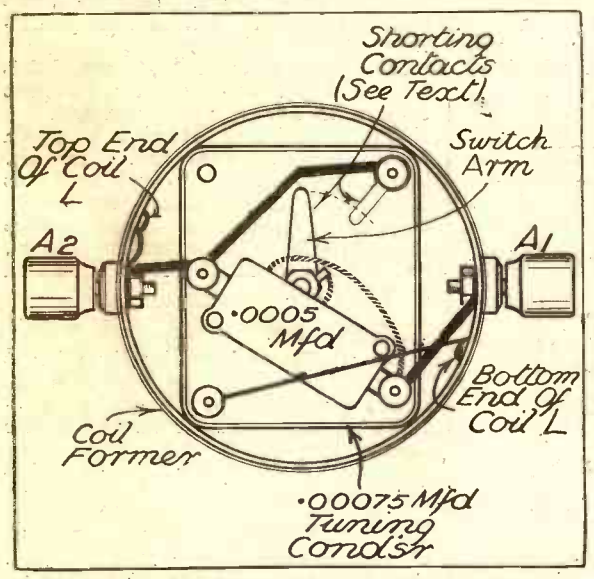
But it is only right that we should point out that many of you may never feel the need for this, as the trap does not noticeably affect the reception of long waves and, as we have already said, actually improves the medium-wave general selectivity and sometimes the power.

However, the refinement is easy enough to introduce. A nut-and-bolt is passed through the right-hand empty hole of the condenser (the two terminals being at the bottom). This nut-and-bolt clamps a soldering tag in such a position that a larger tag, attached to the spindle of the condenser, will make contact with it when the condenser knob is turned fully anti-clockwise (see sketch below). The variable condenser is mounted on a piece of 5-ply or other suitable wood, which in turn is held in the end of the former by means of three wood screws.

If this piece of wood can be cut as a circle to fit neatly in the end of the former, so much the better from the point of view of appearance. On the other hand, this, as you will know, is not an essential in the technical design of the device.

The fixed condenser is supported by means of its own connections.

IMPROVES YOUR SET'S SELECTIVITY



This diagram shows the complete scheme of connections for the wave-trap, and also illustrates how the shorting contacts overlap one another as the spindle is turned.

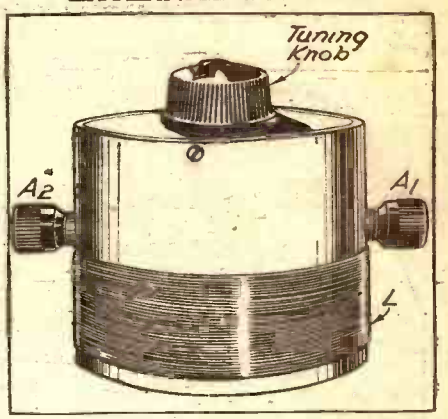
The wiring is very straightforward, but don't rush it. It is vital that the connections to the condensers should be exactly as shown in our diagram.

Easily Fitted.

If it were desired to trap, more or less permanently, only the one station, then the wave-trap could be accommodated inside the set, providing there was room for it. Otherwise it can be stood just behind the set and close to the aerial terminal.

The external connections are also of great importance. The aerial lead-in is removed from the set and joined instead to that terminal of the wave-trap that is connected to both of the condensers: in other words, the terminal A_1, which constitutes a junction between the variable and the fixed condenser.

EXTERNAL DETAILS



Note that the winding is arranged at the bottom end of the Paxolin former.

There must be no direct connection between the aerial and the coil when the trap is in action.

The remaining terminal of the trap is connected to the aerial terminal of the set by means of a short length of wire—the shorter the better.

Now, when you adjust the trap you must remember that it is extremely effective. Therefore its trapping is accomplished in a very *small* movement of the control. So turn this control carefully and *slowly* until you arrive at the critical point where the undesired broadcaster is silenced.

Made in a Few Minutes.

All that has to be done to put the trap out of action is to turn the control to operate the self-shorting device. Or, should it be thought unnecessary to bother about the self-shorting tag, you simply restore the aerial lead to the set's A terminal.

Although we have described every detail, the actual construction of the unit is simplicity itself. The whole operation, including coil-winding, is the work of only a few odd minutes, but you will be delighted with the clean-up of your reception that the unit provides.

TRIMMING A TURNTABLE

By J. W. CAMPBELL.

Obtaining smooth running by balancing with lead.

AFTER removing the clockwork motor of my gramophone for cleaning and relubricating I started it running while holding it, the motor being attached to the board and turntable in position.

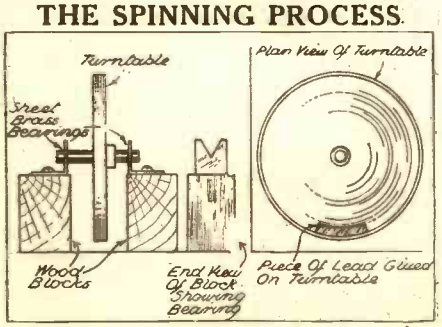
While it was running I noticed that it gave my hands a decided swinging motion. I therefore concluded that the turntable was badly out of balance, though running quite true on the edge and face.

This, I thought, might possibly account for a wavering tone which is often blamed to a *swinger* record—i.e. one in which the hole is slightly out of centre.

So I decided to correct the balance with what means I had at my disposal. In the junk box I was lucky in finding a piece of round steel which was a snug fit in the hole of the turntable and projected about 1½ in. on either side. From pieces of scrap ⅛-in. sheet brass I made two right-angle brackets, as shown in the sketch, with a V-notch in one edge and a hole to take a stout wood screw. The edges of the V-notches I filed up sharp to reduce friction to a minimum.

I screwed the brackets to two blocks of wood of sufficient height to allow the turntable to revolve when resting on its temporary spindle in the V-notches. The turntable was then given a gentle swing

THE SPINNING PROCESS.



The turntable is removed from the motor and mounted in temporary bearings while the operation is carried out.

and allowed to come to rest on its own account, which, of course, brought the heaviest portion to the bottom.

From a piece of sheet lead ⅛ in. thick I cut a piece about ½ in. wide and 2 in. long, shaped to lay snugly against the outer rim on the *underside* of the turntable. The lead was given a spot or two of liquid glue and pressed into position at the *top* of the turntable, opposite the heavy portion.

How the Error Was Corrected.

The turntable was then given a swing, and came to rest with the lead on the bottom, which was as intended. Then, removing the lead with the blade of a knife (the glue remains tacky for some little time), I snipped a piece off, pressed it back into position and tried again. By repeating this operation a few times the turntable was made to come to rest with the lead in any position. When the correct weight of the lead was arrived at it was given a coat of glue and pressed firmly into place and allowed to set.

No doubt many up-to-date turntables are correctly balanced before leaving the factory, but mine was one of the cast variety and several years old.

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TESTED AND FOUND-?

Being Leaves from the Technical Editor's Notebook

THE NEW POLAR MICRO-DRIVE

WHAT a tremendous difference the controls of a set can make to its performance! I often wonder if we have not here one of the most important reasons for the spectacular results achieved with modern apparatus.

Nearly anyone can tune in at least a dozen stations with almost anything in the way of a set nowadays.

I know station powers have risen, that valves are better and so on and so on. But aerials are worse! People don't erect fifty-feet masts like many of the earlier listeners. Aerials are, in fact, shrinking. They've shrunk from the garden into the house, and often they shrink to little gadgets the size of eggs—and that's practically nothing!

Now try to visualise tuning to the "edge of reaction" or adjusting a "superhet" with no gearing between the tuning dials and the condensers!

That's the way for all but an expert, with a steady hand and extreme patience, to miss programmes.

And what a leap forward from that "plain" control to the New Polar Micro-Drive Arcuate which is, in truth, the ultimate of refinement in microscopic adjustment.

Not that you have to twist a knob a hundred times to move from one station to another.

There are actually two drives, both operated independently by concentric knobs. The larger knob gives you a 7 to 1 reduction, and that is a perfect ratio for ordinary purposes.

But when you are "on" the station the little knob, with its 100 to 1 ratio drive, can be manipulated to give just about as precise a setting as could conceivably be possible.

In this way the least experienced and most ham-handed of operators can obtain the finest of tuning.

Both the drives are beyond criticism, free from the faintest trace of backlash or slip, the 100 to 1 being quite superb and, for short-wave work particularly, definitely superior to anything similar I have encountered.

The device is fitted with a baseboard mounting bracket for use with single or ganged condensers, and there is a fine escutcheon and two scale lights.

In addition to this "Arcuate" model, with its inclined scale having full vision, the Polar Micro-Drive is also available at the same reasonable price of 7s. 9d., with either a horizontal or a semicircular scale. There is also a conventional moving-scale model at 6s. 6d., so that every imaginable individual fancy is catered for.

Ratios of 7 : 1 or of 100 : 1 are obtainable with concentric knobs on this micro-drive.

The makers of this outstanding drive are, of course, Messrs. Wingrove & Rogers, Ltd., of 188/9, Strand, London, W.C.2, to whom all constructors, including short-wave fans who are interested in a worth-while tuning-control development, should write for the appropriate literature.

BULGIN MAINS RESISTANCE

You may remember my fairly recent notes on this page regarding the skeleton-type Bulgin components. These are components shorn of polished cases and other such refinements, but perfectly complete in so far as the fundamental requirements of a set are concerned.

This allows the constructor to save money without losing efficiency or adding to the work of assembly and wiring.

For example, there is now a Bulgin skeleton-type Mains Resistance especially designed for use with indirectly-heated D.C. or universal A.C./D.C. valves.

These are made both for 16-volt 0·25-amp. valves and for 20-volt 0·18-amp. valves. They also have tappings enabling them to be used with any mains voltage from 200 to 250 volts.

Another very good feature is that there is a range of them, each clearly marked to serve a definite number of valves.

A complete range of types to suit receivers with from 2 to 7 valves is available in this Bulgin resistance. The price of each type is the same—4s.

So no calculations are needed. Whatever the number of valves, 2, 3, 4, 5, 6 or 7 of either of the above types, there is exactly the right resistance to hand at the same price of 4s.

The resistance is substantially constructed of nickel-alloy wire on a stout porcelain tube, and is a thoroughly satisfactory product from every point of view. It is made by Messrs. A. F. Bulgin & Co., Ltd., Abbey Road, Barking, Essex.

THE "J. & M." REPRODUCER

During the past few weeks I have been doing a lot of work on the very low audio frequencies in connection with a startling idea that has germinated in my mind.

You may or may not hear a great deal about this on some future occasion; that depends upon the success (or failure!) of my experiments.

But this can at once be said about them: my researches have incidentally brought to light a veritable flood of useful new facts about sound in general and loudspeakers in particular.

I don't suppose there are many research workers in the whole of the world who have closely studied, from a practical as well as a theoretical angle, "sound" frequencies of the order of 10 cycles and lower.

For one thing, it is hopeless to attempt to produce them with normal apparatus. But I must not deal at length with this fascinating territory in these notes or I shall over-run my space without accomplishing my real purpose and that is to introduce new apparatus.

Here is a loudspeaker which gives a clean rendering down to 16 cycles — the lowest audible limit of sound. Such an achievement necessitates extremely free suspension of the diaphragm, and a large degree of movement. The "J. & M." accomplishes its bass reproduction without upsetting the other end of the musical scale.

But it so happened that while I was right in the middle of my experiments a "J. and M." moving-coil loudspeaker arrived for test from Messrs Jagger & Millington, of Deighton, Huddersfield.

I was at once struck by the freedom of movement of coil and diaphragm of this loudspeaker. It was quite exceptional for a small permanent-magnet type.

And I was in a particularly advantageous position to test, under the best possible circumstances, the value of this feature.

I found the "J. and M." able to handle hefty inputs and to give a clean bass rendering down to the lowest audible limits of 16 or so cycles, although it maintained good sensitivity to low power.

It is often suggested that the average loudspeaker "cuts off" at 50 cycles. This is wrong, though there is seldom anything more than a fractional rendering, highly coloured.

Despite its bass powers, the "J. and M." was able to achieve a first-class treble, and there weren't any peaks to be noticed.

By the way, I hope you appreciate that to get those really low notes you have to use very special apparatus and big power. Also that a sizeable baffle is needed. For instance, mine is over 12 by 12 feet for "ordinary" responses, and the whole side of a room for the lowest notes!

However, even if such a speaker as this wonderful little "J. and M." is not provided with the power, feed and baffle it merits, it can still evince the value of the principles inherent in its design.

I was so impressed by the results given by my sample that I at once wrote to the makers for a second sample to check my results. When this came it gave just as grand a performance in every way.

At 39s. 6d. it appears to me to be an extraordinarily good proposition, and I hope it sells to the tune it deserves.

Jottings of Interest to Buyers,
By G. T. KELSEY.

THERE is, in my opinion, a growing need for legislation to settle once and for all the question of "man-made static" on a wholesale basis.

I have repeatedly called attention to this matter in my notes, for it seems to me that unless it is made a punishable offence to install electrical apparatus without taking due precautions to see that interference is not caused with radio reception, the problem is likely to become insurmountable.

Commendable efforts have already been made by several of the leading firms in the industry to combat the menace of man-made static, and, but for the industry's enterprise in this direction, there is little doubt that conditions to-day would be infinitely worse than they are.

Records of Interference.

The latest firm to join in the war on man-made static is Marconiphone, and the thorough way in which they have set about it will earn for them the admiration of thousands of troubled listeners.

Engineers and experts working at the Marconiphone factory at Hayes have split up the various sources of interference into cause and effect, and a series of gramophone records has been made on which are noises characteristic of every type of interference commonly met.

The records, together with a 36-page manual describing how each of the recorded types of interference arises and how best it can be cured, are supplied to Marconiphone dealers in order that they may deal effectively with all cases brought to their notice.

This is certainly a big step in the right direction, and, until such times as legislation is possible, it should help tremendously to clear up a lot of the troubles which exist.

Radio for the Deaf.

I am very glad to see that the commercial-set manufacturers are at last giving serious attention to the question of deaf listeners.

H.M.V., to the fore as usual, has just carried out an experiment which shows that deaf persons, provided their hearing organs have not been totally destroyed, can hear programmes perfectly with the aid of special headphones.

Apparently a well-known knight approached

(*Continued on page* 48.)

G. P. KENDALL B.Sc. on TELEVISION

CATHODE-RAY RECEPTION

IN my last article we arrived at a point where we had a tiny spot of light on the end of a cathode-ray tube, and we had learned that this spot could be made to move about by applying varying charges to certain electrodes inside the tube.

Now let us see if we can get a clear idea of the way we can make the spot move around in the special fashion we require

Despite the apparent complexity of its operation, the basic principles of cathode-ray operation are fascinatingly simple, as will be realised after reading this clear description by our well-known contributor.

for a proper job of scanning. First we will imagine that we have just a single pair of electrodes in the form of small plates placed one on either side of the stream of electrons (They were illustrated last week.)

If these plates are not charged the ray will not be affected; but suppose that we apply a negative charge to one and a positive charge to the other: the electrons will be attracted by the positive charge and repelled by the negative one, and the effect will be to bend the ray towards the positive plate and so displace the spot on the "screen." It will move to a new position, and there remain so long as the two charges are maintained on the control electrodes.

This merely demonstrates what we already know, and you may not think it helps us much in getting at the requirements for a real scanning system. But wait a minute. Let us take another step and imagine that we have next applied an *alternating* voltage to the control plates.

The Spot Darts Back and Forth.

The effect of this will be to make the spot dart back and forth on the screen at a rate fixed by the frequency of the alternating voltage. It will normally do this too fast for the eye to follow, and so the result will be that a bright line will appear instead of the single dot which was seen before.

Still we have not got what we want for scanning, although we are obviously getting nearer. Let us look at the manner of movement of the spot a little more in detail, and see what we really want it to do to give us the first component of a scanning system.

Take first a vertical movement which causes the spot to keep crossing the screen from top to bottom. In the case of the cathode-ray tube this effect is secured by making the spot move down at a certain definite speed, and then, on reaching the bottom, flick back practically instantaneously to the top and start down again.

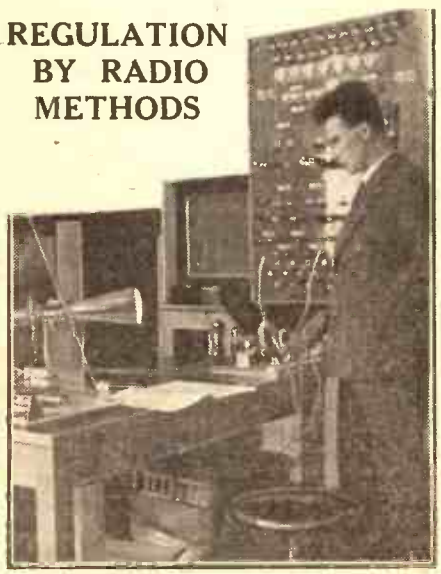
The effect of this on the eye is as though a succession of spots chased each other down the screen in the normal scanning fashion, the flick back to the top, after each downward travel, being so quick that it has no visual effect.

The Time-base Method of Control.

To produce this sort of action we have to apply to the control electrodes a series of voltage impulses of a peculiar kind, such as we do not encounter in ordinary electrical or radio work. Each impulse must produce a gradually increasing positive charge on one plate and a corresponding gradually growing negative charge on the other, and then suddenly both charges must vanish (or in some cases reverse) to allow the spot to shoot back to the starting point ready for the next cycle of events.

It will be noted that I call the charges "gradually" growing ones, but it will naturally be understood that the whole process takes place at the usual high speed involved in scanning.

REGULATION BY RADIO METHODS



This engineer is testing a cathode-ray equipment, and it will be noted that the time-base outfit under the switchboard is built very much on the lines of a radio set. The electrical regulation of scanning is where the cathode-ray tube scores heavily against mechanical methods.

Just how it is done is a subject I cannot hope to cover in any detail in the course of a general explanatory article such as this. In brief, it is done with the aid of a special type of circuit of the kind known under the name of "Time-base." Such circuits usua ly incorporate a system of resistances and condensers in conjunction with a neon tube and one or more valves, sometimes of a special type.

The effect of a gradually growing charge, at certain points in the circuit, is obtained with the aid of a certain property of the neon tube, which causes it to break down when the voltage across it has risen to a

Hailed as a possible solution to the outstanding television problems, the cathode-ray tube is certainly an amazingly interesting device, and this instructive article, therefore, makes singularly good reading.

particular value. This is caused to empty the charge from one or more condensers, which then fill up again relatively slowly through the resistance system, and the cycle thus keeps on repeating the same action.

Again note that when I say "relatively slowly" I mean slowly only by comparison with the instantaneous nature of the discharging process. The actual speed and frequency of the complete cycles of the operation is really very high, since it must cause the receiving spot to keep in step with the sweep of the scanning spot at the transmitter in just the usual way.

The actual frequency, by the way, is fixed by the electrical constants of the time-base circuit, so that it is very easily adjusted, which explains why the cathode-ray type of television receiver is so simple to synchronise. In some forms the time-base circuits are helped to keep dead in step by using the synchronising element of the signal in very much the usual way, and in others we rely on the accuracy of the receiving circuits alone.

Obtaining Lateral Movement.

So far we have considered only the vertical movement of the spot, and the arrangements we have imagined would only make the spot keep shooting down the screen on the same line the whole time.

As we know, this is not sufficient, and we want the successive sweeps to move progressively across the screen from one side to the other, going back to the starting point and beginning again after the whole surface has been covered.

This we can easily do by applying the same principles once more with the aid of a second pair of control plates placed

(*Continued on page* 48.)

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

THE MICROPHONIC VALVE AND "SOUND AND RADIO WAVES."

Quite a number of readers have written interestingly about the above subject, which was referred to in "Radiotorial" of our March 3rd issue.

Among them is the original querist, Mr. Bushell, of Liverpool, who covers a point that has been raised repeatedly in the correspondence by saying, in his second letter: "I must apologise for not asking the question about the microphonic valve complete, but I should have added to my first query the words: . . . 'and to complete the vicious circle how does the high-pitched whistle in the loudspeaker vibrate the filament?'"

He points out that sound waves from the loudspeaker may reach the glass bulb, but they cannot reach the filament itself, as this is in a vacuum.

So he rightly supposes that what happens is that the vibrations of the valve's outer case are transmitted mechanically to the filament by it supports, etc., thus causing the movement of the encased electrodes which gives rise to the characteristic microphonic howl.

An interesting variation on the same theme is contained in a letter from another reader, Mr. Colin A. Joyce, of "The Drum," Dover Road, Walmer, Kent.

He says: "In Mr. Bushell's case undoubtedly it was a case of mechanical vibrations of the filament transmitted electrically through the set and speaker, as is usual with a microphonic valve. I have a rather different case, though.

"I have an H.F. valve which performs exactly as Mr. Bushell's, but in addition to this you can hear the same noise at the same frequency (very high pitched) when the valve is not in the set, but just plugged into a valve holder of a test panel and supplied with filament voltage only!

"You can hear the noise, direct from the valve, of course, at least four feet away."

Evidently Mr. Joyce has given considerable care and thought to his experiment, for he goes on to say: "My idea is that the filament vibrations are transmitted down from the filament via its connecting wires to the base, or possibly to the glass pinch, and then up to the glass bulb, causing *this* to vibrate and send out sound waves into the air.

"If I hold the glass bulb in my hand it slightly alters the pitch of the vibrations, but does not stop them altogether."

This is certainly a curious case, and it will be interesting to know if any other readers have had a similar experience.

CHARGING L.T. FROM THE MAINS.

S. E. (Birkenhead).—"I am using an eliminator to give me high tension from the mains.

"If possible I should like this to give me low tension as well, to charge my accumulator whilst the set is not working. Is it feasible to add additional components to break down the volts to charge in this way?

"Please say what would be the necessary new components and connections to do this."

It can't be done. You could easily "break down the voltage" to the low figure which is necessary for L.T. charging, but you could not draw off the requisite large current at that low voltage.

AN IMPORTANT POINT.

FOR BETTER RADIO

The anode lead to a screened-grid valve is always an important connection, and attention to it frequently results in improved reception.

* * *

The advantages of a proper anode connector (obtainable for a few pence) are obvious, especially if the valve happens to be one of the metallised type, since a "short" to the coating from a "whiskery" or loose lead is very easy in such circumstances.

* * *

Less obvious, but quite as important, is the necessity to use a short direct lead. Often a tendency to instability can be cured by employing a screened lead to the S.G. anode, and in any case it should be kept well away from neighbouring coils, grid wiring, etc.

Whatever kind of H.T. mains unit you employ it is strictly limited as to current output because of its own high internal resistance. And the essence of L.T. charging is to provide a continuous and comparatively *large* current at a comparatively *low* voltage, which means that the supply must have a low internal resistance.

Therefore any form of H.T. mains unit is fundamentally unsuitable to supply L.T., and no juggling with extra resistances, etc., will enable it to be employed in this way.

SHOULD THERE BE A GLOW FROM THE FUSE-LAMP?

S. B. S. (Acocks Green).—"I am more than satisfied with the H.T. unit—and yet I am *not* satisfied, if you know what I mean!

"So far as results go, I am 'quids in,' and I get louder and better results than from the battery without the slightest trace of hum. Naturally, I am satisfied with that part.

"But what I am not satisfied about is the bright light I get from the fuse when switching on.

"As it works so well I should not worry much about this either, except for the fact that after the glow had called my attention to the fuse lamp I kept a close watch on it, and then I discovered that it was just faintly red *all the time* the set is on.

"My friend, who has the same kind of mains unit, using a dry rectifier like mine, has no glow at all, even when switching on. But his set is not so powerful as mine, and he says he would not grumble about the fuse glowing if he could get the results I get.

"However, I shall be more satisfied if you can assure me it is all right, or tell me how to get rid of the light in the fuse."

There is probably nothing whatever to worry about, as a glow when switching on is nothing unusual. (It is due to the momentary surge of current whilst the smoothing condensers are being charged up.)

A faint glow also is sometimes experienced whilst the set is in operation, especially if the rectifier works on the voltage-doubling principle. So we can reassure you, and unless the fuses prove to have an exceptionally short life there is nothing you need do in the matter.

EXTRA SMOOTHING IN THE DETECTOR'S ANODE CIRCUIT.

J. W. (Leicester).—"The annoying buzz which I had been unable to get rid of was eventually traced from your suggestion by examining every inch of the loudspeaker itself, when it was noted that one of the clamping nuts had worked loose. Evidently this rattled on certain loud notes or at certain frequencies, because the trouble disappeared as soon as the nut was tightened and has not returned. Many thanks.

"One final question: I saw it stated in 'P.W.' that if an old transformer or choke were placed in series with the detector's H.T.+ lead, and a condenser placed between the set side of this and L.T.—, the arrangement provided extra smoothing and was often capable of removing a final trace of hum from the mains.

"I have tried it, with a slight but distinct improvement. But what capacity should the extra condenser be?

"Believing it should be of the mica type, I used a ·001 mfd., and this is the only one I have got on hand at the moment. But if you think a different capacity would be better I will get another, as the set is so good it will be worth taking out this last little annoyance of hum if it can be done."

The ·001 mfd. is too small for good results, and you will probably find that a very considerable improvement results if this is substituted by a condenser of 1 mfd. or greater capacity.

It need not be of the mica type. But a condenser of reasonably good quality must be used in this position, as it will have the full detector H.T. across it.

HOWLING WHEN THE H.T. BATTERY IS AGEING.

P. L. J. (Beckenham).—"Ever since I fitted the new valves there has been a likelihood of howling when the H.T. battery was more than a month or six weeks old, especially if I attempt to work the set all the evening.

"I am told that decoupling will cure this, using a 2-mfd. condenser and 25,000-ohms resistance.

"But is it necessary to alter the wiring of the set inside, or can it be done without that?"

In the majority of cases there is no need to alter the internal wiring, because the lead supplying the H.T. to the detector (which is the one we want to decouple) is separate from the other H.T.+leads.

If that is so in your set all you need do is to undo the detector's H.T. lead from its H.T.+ terminal and insert the resistance there, between the battery and set, at the same time joining one side of the 2-mfd. condenser to this H.T.+ terminal.

Then the other side of this condenser is joined to the H.T.— terminal of the set, and the alterations for decoupling are completed.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

ADDING AN OUTPUT CHOKE SPOILS QUALITY.

W. W. (Derby).—"I use the 'Comet Three,' and it gives wonderful reception, but there is one snag.

"To bring it a bit more up-to-date I fitted an output filter, but the quality then became terrible.

"There is a rough hum, and music and speech are cut up and ragged. I get the H.T. off the A.C. mains, with an Atlas unit.

"I cannot make this roughness out, because both the choke and the 2-mfd. condenser are in perfect order when worked on another set, where they have been tested since they caused my set to hum.

"I have a good earth, a good set and a good choke and condenser for output filter. But I cannot use them together.

"As I want to relieve the loudspeaker of the plate current, what can I do?"

If the choke itself is O.K., as you say, and the hum arises only when it is fitted, you are suffering from interaction. It is probably a feed-back through magnetic coupling between the iron-cored components.

In such circumstances the position of the choke is the first thing to query; if you have it mounted on the original baseboard it is probably too close to some of the other components, so fit it with flex instead of stiff wires, and try the effect of moving it about to various positions.

Usually it is advisable to have its iron core placed at right angles to any other neighbouring core, such as that of an L.F transformer: and standing the choke on end or raising it on a block of wood should be tried, if necessary, as there is probably one position for it in which the feed-back is negligible.

It may be necessary to keep it right outside the set (made up as a separate unit, with the condenser), but in that case do not place it too near the mains unit, or you will have the same liability to trouble with that.

A little experimenting with the position along these lines should cure the trouble. But remember that the leads to the choke, etc., and those to the loudspeaker must be kept well spaced away from aerial and other set-leads, or the hum may take place from this cause.

EARTHING A SWITCH ROD IMPROVES STABILITY.

"Having benefited many a time and oft from the trials and troubles of others, as recounted in 'P.W.,' I have pleasure in supplying one of those freak faults which you sometimes describe," writes a Gloucestershire reader, who asks that he shall be known as "Perplexity" when this appears in print.

FAULT FINDING

If you are up against a radio problem remember that our Technical Query Department is thoroughly equipped to assist our readers, and offers you its unrivalled service.

Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do. On receipt of this an application Form will be sent to you post free immediately. This application will place you under no obligation whatever, but, having the form, you will know exactly what information we require before us in order to solve your problems.

LONDON READERS PLEASE NOTE: Inquiries should **NOT** be made by phone or in person at Fleetway House or Tallis House.

"Perhaps the best way to describe the actual trouble is to say that the set appeared to be too lively," he wrote.

"It was built on the lines of the 'Airsprite Four,' and it used to run into patches of bad or 'rough' reception, necessitating very careful handling in order to get the proper quality back. It seemed 'edgy,' in fact.

"Quite by chance I discovered that this was completely overcome by the simple expedient of connecting the coil switch rod to the metal foil which covers the baseboard. I did it with flex.

"There is no doubt about this being the cure, because if the flex is undone the fault is liable to come back, whereas it never does while the flex is on.

"If you can account for it I should be interested to hear the explanation," he concludes. "But, in any case, it may help some poor chap who cannot make out why his quality is sometimes not up to the mark."

Such a fault would appear to be due to H.F. feed-back, and we have pleasure in passing the tip on as an instance of how small a thing can affect the stability of a set under certain conditions.

WHERE ARE THE U.S.A. MEDIUM-WAVERS NOW?

C. O. W. (Shaftesbury).—"Where are the U.S.A. medium-wavers now? Until a fortnight ago I used to have very little difficulty, night after night, in picking up at least one good easily recognisable station.

"But now they seem to have vanished from my aerial, and even a carrier is tuned for in vain some nights. Is this usual, or am I now being specially unlucky for some reason?"

Reports indicate that there has been a big fall-off in transatlantic reception just lately, but some readers still seem to be able to raise a programme from the United States at times well after midnight.

It is quite possible, however, that there will be another period of comparatively easy reception before the summer fall-off, so you should keep on trying for a few weeks longer if you happen to sit up late enough.

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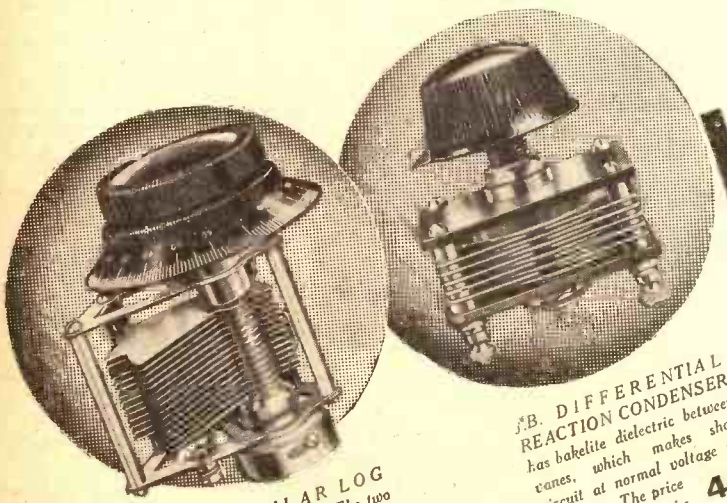

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Advertisement of Jackson Bros. (London) Ltd., 72, St. Thomas' Street, London, S.E.1.

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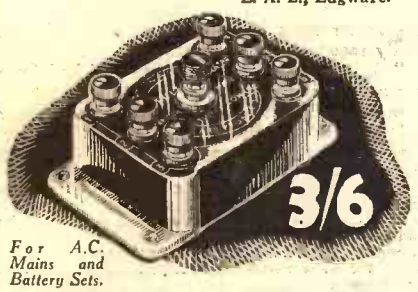
"It worked beautifully on my set, which had been overlapping on stations since the change-over of wave-lengths."
E. A. L., Edgware.



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CATHODE-RAY RECEPTION

(*Continued from page* 45.)

at right angles to the first ones, and energising them from a second time-base system adjusted to the right frequency.

Then, while the first pair of plates is causing the spot to keep shooting *down* the screen, the second ones will draw it gradually *across* until it reaches one side. When it arrives there the charges on the second pair of deflector plates will suddenly vanish, so allowing the spot to drop back to its starting point ready to work its way across once more and providing the normal scanning action.

The Question of Light Control.

As I said just now, I cannot possibly find space to treat this very large subject in the detail which it really deserves, but I have given you a general idea of the principles which are used. There are many ways of applying them in actual practice, and I would certainly advise the keen student of television to look up at least one practical example, such as the complete cathode-ray receiving system which was described in "P.W." last year, (See May 27th, 1933 issue.)

So much for the scanning system. Now we come to the question of light control, and this turns out to be delightfully easy with the cathode-ray tube. We have seen that the *direction* of the ray can readily be controlled by means of charged electrodes placed in its vicinity, and our knowledge of valves prepares us for the fact that its *volume* can be varied in a very similar way.

Acceleration by the Anode.

Thus we shall find that, if we superimpose the television signals on the voltage on the anode of the tube, we shall enable them to control the accelerating effect of this electrode on the electron stream, which does just what we want. It actually causes the *brightness* of the spot to vary, and so we get our modulation effect, in addition to scanning, all in the one device.

This, it is to be understood, is only one way of achieving our end, but it demonstrates the principle. If the student of the subject grasps this particular method he will find no difficulty in understanding others which he may encounter later on. I wish I had space to cover *all* the ways of using the cathode-ray tube and its detailed construction, but I'm afraid I must confine myself to just the broad principles.

THE NEED FOR EXPERIMENT

(*Continued from page* 33.)

including television. The chief purpose of all sections would be to devise new ways in which existing material could be prepared and presented.

In music, for example, there would be attempts to get away from the monotonous sequence of concerts of the standardised type. In variety there would be a constant search for new ways of "getting across the microphone." What is wrong at present is not only that the staff and means of experiment are inadequate, but also that the "experiments" are made on the public in the first instance. A proper organisation would see to it that experiments were fully tried in private before the public release of those considered worth while.

It is difficult to exaggerate the importance of this aspect of broadcasting. The tendency to monotony and staleness is a constant factor. The broadcast programme does not run for weeks; it is finished with two public performances. This creates an insistent demand for novelty and change.

Among the ancillary services of broadcasting that require more attention in future are News and the Children's Hour. The News Bulletins are already being experimented with and notable improvements have been made. It would seem that the microphone lends itself to eye-witness accounts of current events from the scene of happening. Thus the tendency is to depart from the set form of News in narrative which has been standardised in the Bulletins.

News and the Children's Hour.

American practice is to create news-collection machinery separate from the Press agencies. This is unlikely to be imitated in Great Britain, where the News agreements between Press and broadcasters are on a firm and satisfactory basis of co-operation. So it will be the skilled journalist on the spot who will provide the eye-witness account. It is pretty well established that the printed word need not suffer—may, indeed, benefit—by this development.

The Children's Hour has never received the attention or resources it deserves. Nevertheless, the officials responsible have gallantly carried on. They have transformed the rather puerile early efforts into something resembling real programmes for children. The process should be continued; nor need these programmes be confined to an afternoon period. Programmes for children can be acceptable to adults, especially if they are really good enough for children. Therefore I would like to see an occasional programme for children in the main evening listening time.

THE LINK BETWEEN

(*Continued from page* 44.)

H.M.V. with a view to ascertaining whether it would be possible for him to enjoy the programmes provided by his H.M.V. seven-valve radio-gramophone which he had bought for his family. For some years, the gentleman in question had only been able to hear music badly distorted through his ordinary hearing apparatus, and although, without this apparatus, he was unable to hear speech or music, now, thanks to H.M.V., he is able to enjoy a radio transmission or entertainment from records to the same degree as a person of normal hearing.

This modern miracle has been achieved by means of specially-wound headphones, which employ cones in the earpieces instead of the usual flat diaphragms. Following the success of this first experiment, some of the H.M.V. radio-gramophones are now arranged so that a switch at the back enables a deaf listener to use the instrument with the ordinary loudspeaker in the set disconnected.

In the interests of humanity generally, I look forward to a considerable extension of activities in this direction.

Another "Sound" Scheme.

Here's another item of news which will be of particular interest to those who are hard of hearing.

Multitone has just produced a set specially designed for deaf listeners which, in addition to providing them with wireless programmes, enables them, when the radio is not wanted, to join in conversation going on in the room.

The speakers need not address themselves to the deaf person, nor be of necessity close to the instrument. By means of a special attachment, the set picks up all this is going on in the room and passes it on to the deaf person. Another salient feature is that the volume of sound in the earphones can be adjusted independently of the loudspeaker volume level at which the others in the room desire to listen.

This new Multitone set is an ambitious attempt to solve the problem, and I am confident that it will become deservedly popular.

SOME "BIFOCAL THREE" QUERIES

SINCE the publication of the details of the "Bifocal Three" on March 3rd the Query Department has received innumerable letters from readers who ask various questions about the Bifocal coil and its operation.

It does not seem to be generally realised that the "synthetic" variation of the aerial tap into the coil, which is carried out by the movement of the plunger in the coil, is to be looked upon as an independent adjustment of the set.

The Focusing Adjustments.

In the "Bifocal Three" there are two of the coils, and therefore two separate adjustments of these coils. Because it is decided that, say, the aerial coil is to be focused (the plunger position varied) it is by no means essential or desirable that the selectivity of the anode coil be altered, unless, of course, full adjustment of the first coil is not sufficient to bring about the desired result.

Usually the aerial circuit is the flatter of the two, and therefore it is best to try to focus the set on the aerial side first, making subsequent adjustment on the other coil if required. It must not be thought that, because there are two coils, with two plungers, equal adjustment on both coils is essential.

Because the focusing rod of one coil is halfway in there is no *need* for the rod of the second coil to be in a similar setting. It may be advantageous so to place it, but it is by no means necessary that the two coil settings shall match.

Straightforward in Operation.

Some readers seem also to be in the dark about the way to operate the "Bifocal Three." Let me assure them that, in every respect but one, the receiver is exactly the same as any other three-valver with two tuning dials. There are the two dials for tuning, two wavechange switches, on-off switch and reaction. Where the set differs from others is in the push-pull selectivity, or focusing, controls.

Forget these when you are station searching. Pull them about halfway out—or right out if there is little interference in the ether—and tune away on the dials and reaction until you get the required station, with or without interference.

Controlling Volume.

If other stations are troublesome the two plungers are pushed farther in—one at a time; there is no need to do them both together or you may overdo it and lose the station you require. Should no interference be heard, and the plungers are not right out, pull them out, thereby flattening the tuning and getting the best quality and greatest strength of reception.

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K. D. R.

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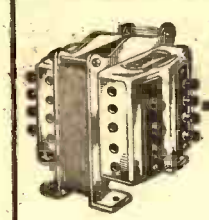

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EUROPEAN VALVE PATENT BATTLE

A LONG patent battle has been going on in certain foreign countries in Europe, Philips and Tungsram being involved over some very interesting technical points. Of certain claims put forward by Philips, one of the most important of those disallowed by the courts concerned the "Cascade" patent (re-tuned circuits) on which this company would have been entitled to royalties from Czechoslovakian set makers, but which has been declared to be invalid.

Similarly Tungsram succeeded in a case against the centre-tapped patent.

But a third patent of this group, the grid-detection patent, has simply been restricted in Czechoslovakia in such a way that it no longer covers all variations.

In Hungary important issues centred round a Philips patent for horizontal electrode structure and one on cathode manufacture by vapour process. The supreme court of that country has finally found both these to be invalid.

A new patent application on slanting electrodes, put forward in Germany by the Valvo Company of Hamburg (a sister concern, by the way, of Philips), has been refused in the supreme court there.

THE FREEDOM OF THE AIR!

(*Continued from page* 31.)

Japanese waters. So I chose the subject of the Japanese imperialists, and pitched into the Japanese militarists hot and strong. I did not even have to submit my MS. !

The talk was a success; both the Columbia System and I had a heavy fan mail for days afterwards, and the officers of the broadcasting company were telephoned to with congratulations the same evening by listeners in many parts of the North American continent.

A Famous German "Incident."

But there was a sequel. A strong letter of protest—the only one—came from the Japanese Ambassador in Washington. Were the Columbia officials alarmed? They were not. They sent a courteous reply to His Excellency, inviting him to broadcast a reply the following week. His Excellency did not accept the invitation. This was not because of ambassadorial dignity. He did not speak English very well.

And I think the Columbia people came off best.

One other incident—this time in Germany. It did not concern me personally, and I only heard of it by chance. Before the Nazi Government came into power a Communist managed to obtain access to the big Berlin station, and, in collusion with certain of the inside staff, pretended he was a well-known professor who was to give a talk on archaeological discoveries in Babylon or some such "highbrow" subject.

Shedding his false beard in front of the microphone, the Communist managed to get in several minutes of red-hot propaganda for his cause before they could stop him.

The episode set all Germany laughing. But no one was a penny the worse. The good Germans can listen any evening to hours of Communist propaganda from Moscow. Less of them would do so if there were more freedom of opinion allowed on their own wireless.

The B.B.C. stands half-way between the complete freedom of the air, as in America, and complete bureaucratic control, as in Germany.

And it gets the worst of both worlds.

THE LISTENER'S NOTEBOOK

(*Continued from page* 38.)

Some listeners care little for the play that is based on fact. Personally, I am bored by the fantastic and trivial theme behind some radio plays. Fact, or fancy that is realisable, are, in my opinion, an indispensable basis on which to construct a play, if the play is to carry conviction. Domestic comedy, once a popular type of comedy on the stage, is rarely put on the air.

* * *

Again, some people dislike the long play just because it is long, though these very people will not deny that the pick of the plays yet broadcast have all been long ones. It stands to reason that if a play is to be a good one it must be long. As it is, ninety minutes doesn't give an author much time in which to develop a story.

* * *

I am convinced there is a big public for radio drama, but it must be worth-while drama. One hears nothing but praise whenever a good play is broadcast. All Galsworthy's plays have been memorable broadcasts. Yet they are long. The monthly Shakespeare (lasting approximately two hours) is just lapped up by a wide public. And I make no apology for reminding you once more of "The Green Goddess"—a memorable broadcast, and long withal.

* * *

In my estimation the reason why radio drama as a whole doesn't occupy a higher place in broadcast fare is because of the all-too-frequent diminutive thing that masquerades as a play. It is like a weed that has escaped the hoe till it has so increased and multiplied that it has grown over the choice plant.

* * *

So I would say to the Director of B.B.C. drama: Give us big plays on all subjects to suit all tastes in turn. You have the actors and the actresses, and we have the advantage of listening experience behind us. Take "Quarrel Island," for instance. Everything came through perfectly, and I do say most emphatically that no play has been more clearly spoken.

The entire cast could both act and say their words distinctly. As regards our own receptive powers, "Quarrel Island" proved once again that we can now follow everything with ease. There was never a shadow of a doubt as to who was speaking at any time, and if anyone had ears at all it seemed to me impossible to be in the dark.

* * *

The North Regional criticism that followed "Quarrel Island" was a splendid and helpful innovation, especially to listeners who take radio drama seriously. Naturally, one had formed one's own impressions of the play, and it was interesting to compare these impressions with those of three total strangers.

One of the critics thought that "Quarrel Island" as a radio play would have been helped if the great cry of loneliness set up had been shown off by the Sounds Department putting on a gramophone record, indicating the noisy and happy crowds of a modern European capital.

It is, perhaps, beside the point to say here that such a contrast would have completely spoilt the play. The fact remains, however, that it was an interesting point, and one that provoked an interesting discussion in the family circle.

C. B.

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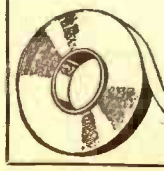

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TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

Using the Field Coil for Smoothing.

I AM often asked whether it is not a practicable arrangement to use the field winding of a moving-coil speaker as a smoothing choke. Every now and again one of my readers wakens up and discovers that the field coil must be an excellent choke, with an enormous inductance, and why shouldn't it be used for smoothing purposes instead of having separate chokes.

Well, the fact is that the field coil *can* be used, and frequently is used, for this purpose, many of the latest receivers employing this arrangement. The coil will often give a high inductance, as much as 50 henries or more, even when carrying a fairly heavy current.

It is a good plan, however, to use the ordinary choke in addition to the field coil, because the ripple which usually remains in the rectified output is apt to be developed across the choke—that is, across the field winding—if this is the only choke used. Since this is in close proximity to the moving coil, the speaker will almost certainly give you a loud hum which it will be difficult to get rid of. Most speakers are, however, specially designed to overcome the trouble, and what are known as "hum-bucking" coils are inserted to absorb the "hum."

Watch the Voltage Drop.

A better arrangement is to use the normal smoothing choke and condenser scheme for ironing out the output from the rectifiers, and then, if you like, to let the inductance of the field winding act as the main smoothing.

Another very important practical point which is sometimes lost sight of is that there will be a considerable voltage drop across the field windings; this may be 50 volts or even as much as 100 volts. If, therefore, you are to get the correct anode voltage you must allow for the drop in the field windings and add this to what you eventually want to deliver. This means careful consideration of the voltage output of your rectifiers.

Dual Speakers.

It is the aim of every amateur to get unto himself a speaker which will give uniform quality in the high and low registers. There have been, of course, enormous improvements in speakers during the past few years, and undoubtedly the best type of speakers on the market at the present time give a remarkably uniform response over a wide range of audio-frequencies.

The idea of using a combination of two speakers has always fascinated experimenters—one speaker, generally with a smaller cone, for the higher register and the other for the lower notes. In theory this is all very well; the lower speaker is supposed to devote its time and attention to reproducing the lower notes faithfully, while the other one is to confine its attention entirely to the upper register. In practice, however, it does not generally work out so. For one thing, the speakers cannot easily be got to operate just in the required regions, and, for another thing, it is not at all easy to get them to give the right volume in relation to each other.

A Convenient Arrangement.

A simple dodge which a reader sends me in this connection is to place the two moving coils or speech coils in series with one another, and then to supply these from the secondary of a single step-down speech transformer instead of using the two transformers belonging to the two speakers.

This arrangement will obviously need to be used with discretion—a good deal depends on the resistances of the speech coils and also on the ratio of the transformer and various other things—but, allowing for variations in individual cases, the idea is a good one, and can be made to work well.

D.C. Mains Receivers.

Although the electric supply undertakings are gradually going over to alternating current, which will eventually become universal, there are still a good many districts where D.C. current is in use, and people who are on D.C. often complain that manufacturers of mains sets do not sufficiently look after them.

It is true that a large proportion of mains sets are designed for A.C., but, at the same time, it is perfectly feasible to operate mains sets on D.C., although not so convenient. In some districts the D.C. is fairly smooth, and little trouble is experienced with ripple and hum, but in other districts it is far from satisfactory.

A common practice is to put the field winding of the moving-coil speaker in series with the heaters of the valves. This arrangement has the advantage, first of all, that it provides a good deal of smoothing for the D.C. current, and, secondly, that it gives you a considerable voltage drop, which you must have for the heaters, even though these are in series.

Extra Inductance Sometimes Needed.

The resistance of moving-coil field windings varies quite a bit; usually it is between 500 and 1,000 ohms. If you assume that the current passing is, say, one-tenth of an amp. 1,000 ohms will give you a drop of 100 volts. This will probably be insufficient, and you may have to put some further resistance in series before you get the right current through the valves.

If you can use a highly inductive resistance, such as a choke, for this purpose, so much the better, because then you will have not only further voltage drop, but the added advantage of further smoothing. By the way, this extra resistance should be tried in the same mains lead as the field coil, and then in the opposite lead, to see which gives you best results.

As regards connecting up of the valve heaters, it is a good plan to have the

(Continued on next page.)

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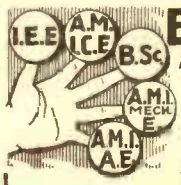

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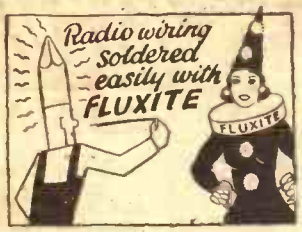

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TECHNICAL NOTES

(Continued from previous page.)

detector heater as near earth potential as possible, but much will depend on individual conditions.

A Curious Effect.

Here is a little puzzle which I came across the other day. I wonder if any reader can solve it for me. I was using two all-mains sets, the mains leads being connected into one set and then continued on to the second. The leads had been cut off from the second set for the time being, and furthermore one of the leads was severed at a point a couple of feet beyond the first receiver.

The leads, by the way, consisted simply of twisted electric light flex, and the reason for severing one of them was that there was a bad place in it and I had decided to cut it and join it up and tape it so as to make it satisfactory.

The position, then, in brief, is that we have one lead about 10 ft. long continuing beyond the first receiver and with a blank end, the other lead continuing about 2 ft. from the receiver, then broken and then continuing to the length of 10 ft. with a blank end, the leads being twisted together.

Was it Due to Capacity?

The curious effect is this. On touching the 8-ft. length of lead (at the point where the break occurred, 2 ft. from the receiver) with the finger or with the blade of a knife, loud cracklings were heard in the receiver. You will bear in mind that this 8-ft. length of lead is not connected to anything at either end and only has a capacity connection with the lead with which it is twisted.

Now, on touching the other broken part—that is, the 2-ft. length directly connected to the mains and to the receiver—no such crackling occurred. Furthermore, I ascertained that neither of the mains leads was connected to earth.

Some Radiogram Points.

I don't know if you have ever noticed what a lot of radiograms suffer from noisy motors. I don't mean electrically noisy, in the sense of sparking and so on being picked up in the amplifier. I am referring to ordinary mechanical noise. One I came across the other day gave out a shocking row when switched on, and indeed almost drowned the music from the record: it *did* on soft passages.

In this case we found that the motor and turntable spindle were both out of adjustment—and incidentally had never been oiled since the year dot—whilst, owing to dirt and dust, the turntable was seated very insecurely on its spindle. We got most of this right, but it was still, in my opinion, a noisy brute after we had finished doing all we could for it. On the other hand, I *have* come across gramophone motors that were so delightfully silent that you could scarcely tell when they were running unless you put your ear quite close. I have formed the impression that spring motors are more often silent than electric ones. Perhaps this is rather a generalisation, and it would be interesting to know what my readers think.

The Dust Problem.

Another point I have often noticed in radiograms is that there is no cover or protection between the motor and the radio and amplifier components, with the result that dirt and dust, not to mention larger objects, drop through into the "works" of the radio set. In a set I was examining the other day you could see through the nicks in the gramophone motor-board right through to the valves, and when we came to examine the insides we found the screens of the H.F. valves were just dustbins, full of all sorts of odds and ends, including a plentiful proportion of gramophone needles!

But how else could it be, with no partition or protection between the two? This is a point worth looking into in your own radiogram.

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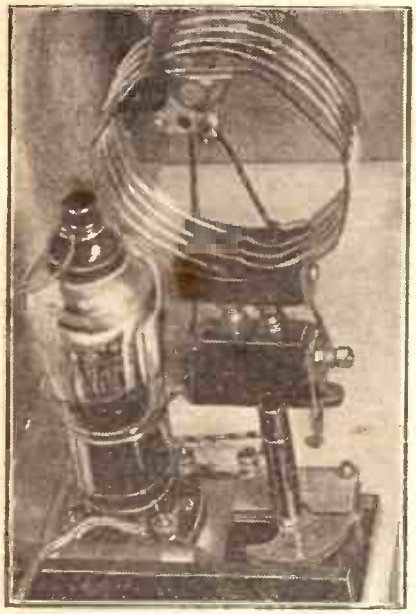

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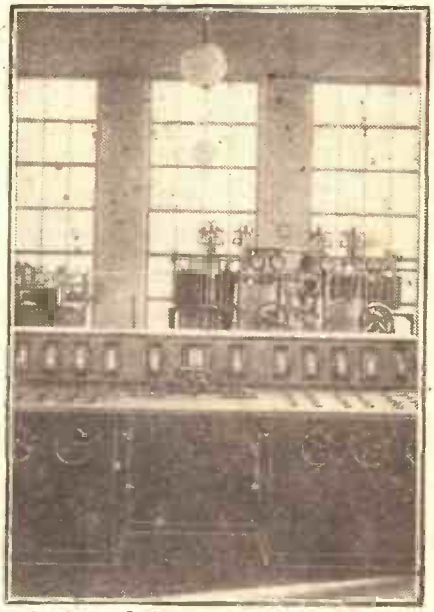

A view of the transmitter room at Bisamberg.

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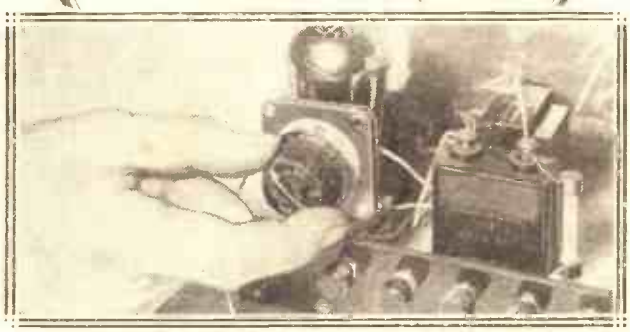

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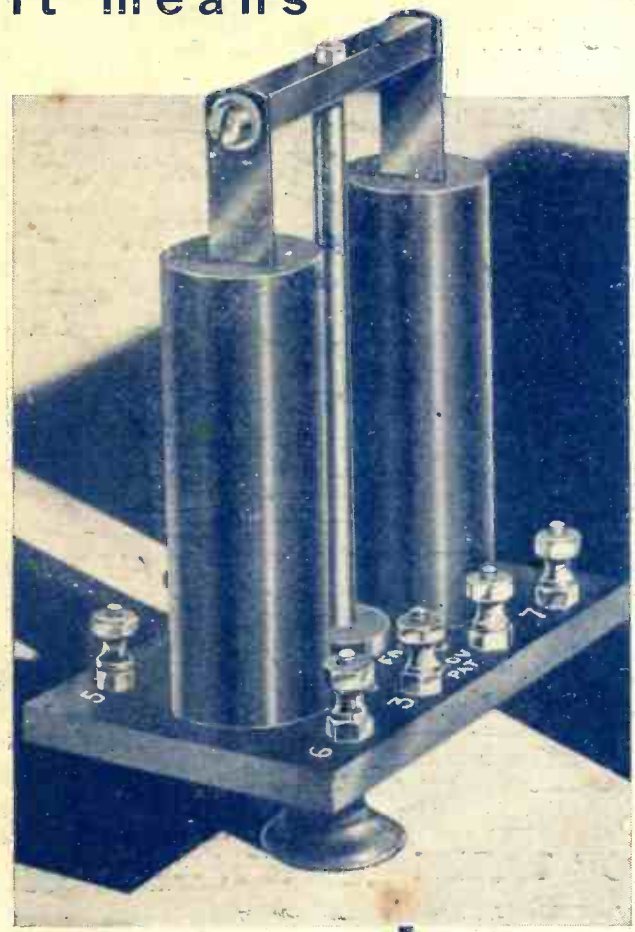

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Write for full particulars of this astounding component—it can be incorporated in any set.

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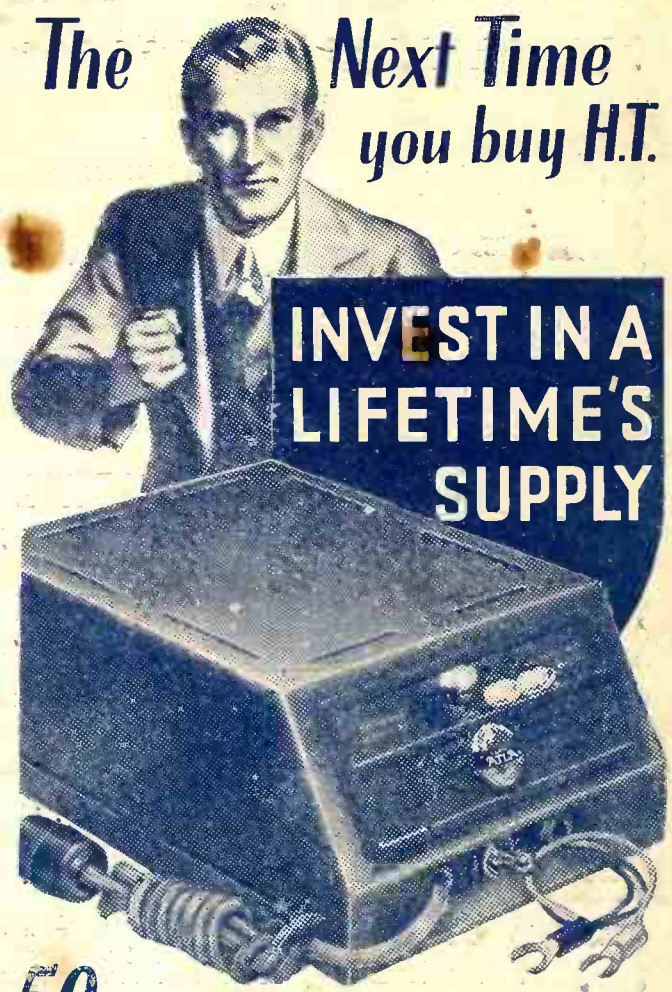
The Next Time you buy H.T.



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ASK YOUR DEALER — HE KNOWS

REGISTERED AT THE G.P.O. AS A NEWSPAPER.

THE B.B.C. INVESTIGATED (See Page 55)

LATEST TELEVISION NEWS

Popular Wireless

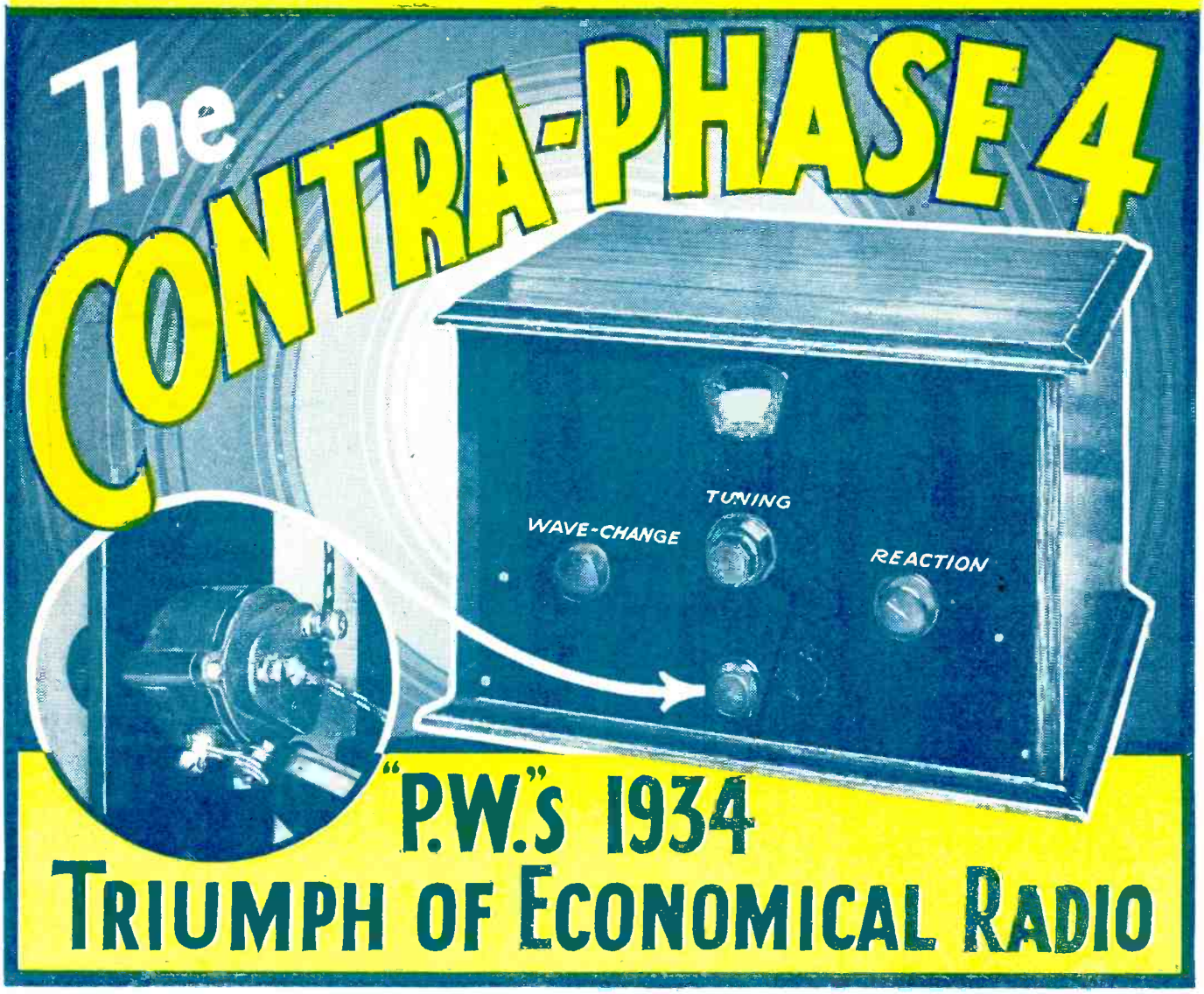
RECOMMENDED WRINKLES

HOW GOOD IS YOUR VALVE?

No. 617. Vol. XXV. March 31st, 1934.

EVERY WEDNESDAY PRICE 3D

The CONTRA-PHASE 4



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COSSOR
Super heterodyne RADIO

. . . brings you every worth-while station
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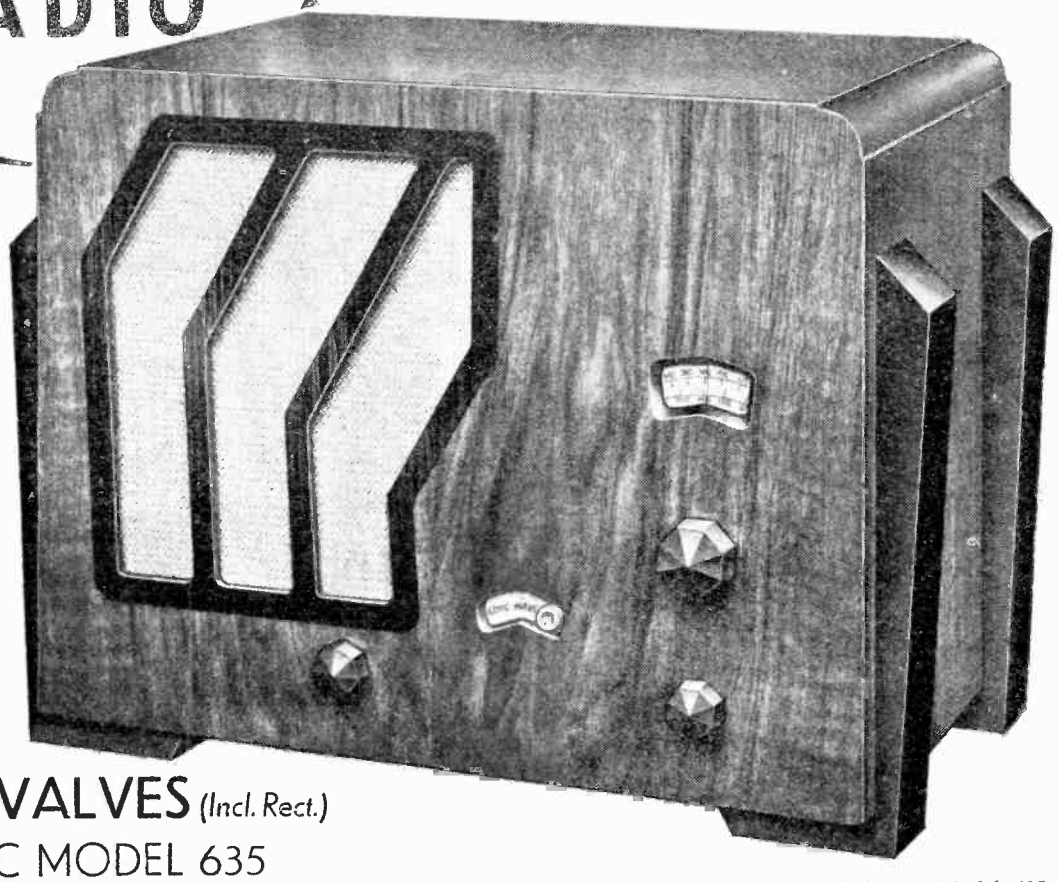

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Illustration shows the handsome cabinet of the All-Electric Model 635, a receiver of truly magnificent performance.

A battery-operated model is also available, the abridged specification being as follows:—

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Class B Output, Moving Coil Loud Speaker, Illuminated Single Dial tuning calibrated in wavelengths; tone control, Walnut finished cabinet with space for batteries. Pick-up plug and socket. Price, less batteries and accumulator - - - - - - - - - - - - **£13.10.0**

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Please send me a copy of your photogravure catalogue of Cossor Receivers (B.20).

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POPULAR WIRELESS
THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

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TELEVISION PROGRESS
PARENTAL CONTROL
LETTERS, PLEASE!
THE MYSTERY MAN

RADIO NOTES & NEWS

THE B.B.C. BOARD
POLDHU PASSES
"PRIVATE RIBBING"
INDISPENSABLE RADIO

Considered Words on Television.

IN the 1933 report of the Radio Corporation of America, which owns the great National Broadcasting Company, I find the usual note of caution concerning television: "Definite progress has been made . . .," but "Nevertheless some important problems relating not only to the technical side, but also the commercial side of television, still call for solution."

Again: "While it is impossible to anticipate the exact time when this development can be introduced on an industrial basis, it may nevertheless be said that the progress made . . . has brought us much nearer the goal . . ."

What Progress Has Been Made?

THE R.C.A. states that outstanding in television research during 1933 was the perfection by them of the "iconoscope"—an electric eye—which facilitates the "pick-up" of studio action and permits the broadcasting of remote scenes, thereby giving to the television transmitter the function of a camera lens.

By means of the "iconoscope," street scenes have been satisfactorily sent and received on an experimental basis. It is interesting to learn that they have produced valves for ultra-short waves so small that their diameter is five-eighths of an inch and the internal elements fitted into a space about the size of a pea.

Flash Messages.

N. A. C. (Beaworthy).—Many thanks for kind offer l.s. for Science Museum. Letter passed to Briggs. Admiration reciprocated.

R. L. G. (Clacton).—No; frankly I do not think influence of radio *altogether* good, but *so good* that world better for it, beyond all question. Same applies to "films."

D. D. (Liverpool).—Impossible reply your query. Many hobbies (chemistry, astronomy, etc.) as intellectual (probably more so), but radio is one of few *all-round* hobbies. Don't hesitate.

F. H. (Kensington).—In early days wireless operators certainly had simpler apparatus, but it was much trickier to handle and called for greater skill and patience. The usual story.

Why the Diffidence?

THE Hon. Sec. of the Exeter and District Wireless Society tells me that it is extraordinarily difficult to induce amateurs to join a radio club, and he believes that the cause is the belief of many that clubs are mainly intended for experts and that the lectures will be above their heads.

That being so—for I think he is right—let me assure all hangers-back that their fears are unfounded, and that any club programme committee with vision and experience realises that the beginner is the best material, and acts accordingly.

ON OTHER PAGES

PAGE
55—"Alternatives are unsatisfactory; they should be more definite and continuous. Broadcasting should run from 8 in the morning until midnight."
57—"I have never yet found a play lasting more than an hour receive the undivided attention of more than half its audience."
58—"It might be better for all concerned if there were more uncensored debates and fewer 'middle' talks."
64—"I certainly do not expect Parliament to sanction the starting of any opposition broadcasting concern."
73—"They have decided to scrap valve pins."

In fact, membership of a "live" club soon turns radio greenhorns into expert amateurs. Hence I advise you to join up at once, wherever you are, if there is a club within a mile or so, and enjoy the spring and summer sessions.

Radio and Flight.

THE great importance which Imperial Airways attach to radio is now recognised by the Spanish air line which operates between Seville and the Canary Islands via Rabat, Casa Blanca, Mogador, Agadir and Cansaba and Fuerte Ventura.

The aircraft have been equipped with short and medium wave sets, and are easily able to keep in touch with both Madrid and Las Palmas during the flight, as well as with other 'planes in flight.

The radio equipment is similar to that used by Imperial Airways on their "Atalanta" class aeroplanes on the African and Indian routes. Listen on 50 and 900 metres.

Why Sleep When You Can Listen?

E. G. W., a Windsor schoolboy—and a very nice one, I am sure—in reporting some glorious adventures amongst the wild Americans on S.W., gloomily adds that he was transferred to his lonely pallet by parental authority just as he was waiting breathlessly for a call-signal. "Why don't parents realise the thrill of S.W. listening?" he asks. Aha! perhaps some of them do, when the rightful owner is asleep, eh?

Never mind, young man; you have many years ahead of you for radio and other thrills—and the day may come when you will thrill at the thought of a good night's sleep. Cheerio!

Do It Now!

THE invitation of the B.B.C.'s Drama Director for correspondence on the subject of radio plays is a new sort of gesture, though none the less welcome because of that. I regard the play as almost the most important of the recreative items of a radio programme and as the one which, despite its satisfactory development so far, needs more study than any other except "talks."

Therefore I hope that there will be a prompt and overwhelming response to this opportunity to let the B.B.C. know what its public wants. Be brief, be clear, be helpful. I am going to write myself!

Licences in India.

I JUDGE from the Indian papers that the new regulations governing the issue of licences and the sale of wireless apparatus are not working quite so well as it was hoped they would. In fact, so far from checking the illegal working of sets, the regulations appear to be merely restricting sales.

Customers are objecting to giving their names and addresses when they are making cash purchases of articles such as grid leaks

(*Continued on next page.*)

THE BOY WHO SOLD NEWSPAPERS

However, the regulations were made in the interests of the public, and I hope that the authorities will persevere, even if some modifications have to be made as a result of experience.

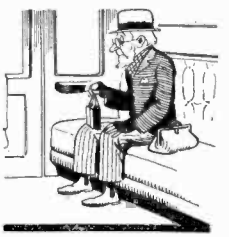
A Pertinent Question.

REFERRING to an article entitled "An Efficient Indoor Aerial," recently published in "P.W." over the initials J. A. C., a Palmer's Green reader asks what happens when the carpet, through which the wire is threaded, has to be removed for spring cleaning.

Any married man knows the answer; but I will give it here in the interests of science and bachelors: The wire has to be *unthreaded* at the speed of light (186,200 miles per second)!

Dickensian, but Modern.

ONE cannot help noticing things. On my train I almost daily see an elderly man, with hair, face and beard like Thomas Carlyle, who never wears an overcoat, though in winter he permits himself a muffler. He is thin and wears a very short, everlastingly buttoned-up jacket. Never has a newspaper, never smokes.



About twice a month he carries a small two-volt accumulator up to town, suspended from a bit of string. Let me be charitable to all men and assume that he *owns* a factory or office where he can get his cell charged for *noddings*.

What the Committee Advised—

SOMETHING recently impelled me to refer to the report of the Broadcasting Committee of 1923, which was set up by the then Postmaster-General. I find that the Committee recommended that the Board of the B.B.C. should be composed of an independent Chairman and twelve members, ten of whom should be "drawn from" the Department of Scientific and Industrial Research, County Councils Associations, Association of Municipal Corporations, Trade Union Congress, Post Office, Wireless Societies, Operating Concerns, Manufacturers, Press and Entertainment Industry.

—And What We Got.

NOW I think we shall agree that some of those bodies most decidedly call for representation on the Board, especially the last five mentioned. What we actually have is a Board consisting of the Rt. Hon. J. H. Whitley, D.C.L., LL.D., Mr. R. C. Norman, Mr. H. G. Brown, the Rt. Hon. the Viscount Bridgeman, LL.D., Mrs. M. A. Hamilton and Sir John Reith, LL.D.

The three LL.D.'s were certainly not drawn from any of the last five bodies; Mr. H. G. Brown is a financial adviser; and you can amuse yourselves by trying to fit in Mrs. Hamilton and Mr. Norman. I should be satisfied if we had *one* Governor drawn from the Entertainments Industry.

The End of a Veteran.

AFTER more than thirty years of useful life the historic Marconi station at Poldhu is to be closed. It was begun in 1900, took part in the immortal "three-dots-across-the-Atlantic" test which put long-distance wireless "on the map," became one of the best-known commercial stations in the world and in 1923 was handed over to Marconi's research men.

Its place in wireless annals and in the affectionate remembrance of the older generation of wireless men is assured, and if it is dismantled altogether I hope that someone will raise a fitting monument on its site.

The New Edison Memorial.

AND talking of monuments brings to my mind the fact that the International Edison Foundation plans to erect a mighty mausoleum and memorial tower over the mortal remains of Thomas Alva Edison. The work is to cost two million dollars and will take the form of a 350-feet marble shaft ending in two hands clasping a great electric light globe. At the base is to be a bronze statue of Edison and, behind, a landscaped park.

Not so bad for the poor boy who used to sell newspapers on the trains; but he really needs no other monument than his work and his character, which are more enduring than marble and more illuminating than artificial light.

"Sculptured Music."

JUST as the war greatly accelerated the study of radio, so the needs of broadcasting and the "talkies" have intensified research on sound. As an example of some of the results, consider the three-dimensional or "sculptured" music which was recently demonstrated by the Bell Telephone Laboratories in New York City.

The effects were produced by three specially designed loudspeakers placed on a stage in the same relative positions as three microphones in a distant studio, and gave the sensation of sound in three dimensions.

The Phantom Bugler.

AMONGST the queer things demonstrated was a "tap dance." It began with the dancer on the stage, but when he walked off the dance continued unaltered and then proceeded to trip all over the stage, finally dancing off in the opposite direction. A similar performance was given by an invisible bugler.

A sketch by hidden speakers gave the impression that they were actually on the stage, though invisible: for they were distinguishable quite easily by their voices and "movements," their positions as they shifted about the stage being plainly determinable. Finally, the bewitched audience heard a revolver shot whistle across the stage, strike a target and then reverse and whistle its way back!

Thousands "Bifocalise."

STRANGE how this focused radio gets hold of one! I've just seen a joyous epistle from two real enthusiasts who are right under the influence of the focusing "bug."

Their letter makes fine reading and will tell you other constructors a deal more than I ever could in these notes. I believe the Editor is printing some of their remarks this week.

But I shan't be surprised to hear that most of you are building the set for yourselves. This focusing is fascinating. I've tried it, and could I drag myself away . . . ?

This Week's Translation.

HEADLINE to paragraph in American radio paper: "Private ribbing just a yawn to public." An announcer and a news reader employed on Station W G Y developed the habit of using the "mike" whilst gambolling with some private jokes of their own.

They were ordered to attend strictly to their legitimate business. The secret code quoted above means "The exchange of repartee in pursuance of a private joke bores third-party listeners."

But this one beats me: "Teaberry Gum Expands Mystery Disc Spots."

Radio—though Broke.

A FRANKFURT court has dispelled the idea that nothing but the baby's cradle is sacrosanct to a bailiff by ruling that a wireless set cannot be seized by a bailiff. The court's reason for this is that, in present-day Germany, radio receivers are indispensable.

I can understand that. Mere printing presses could not keep up with the torrent of decrees! All the same, to be left in one's house with a set, the rest of one's household effects being in the auction room, hardly makes for good citizenship.

A Return Match.

I OBSERVE that the New York "Daily News," referring to the B.B.C. commentary on the Harvey-Gains fight, said: "Those English sports announcers are very polite, and oh, so lackadaisical! . . . They describe the blows in the tones of a drawing-room dude asking for another cup of tea."

Slightly overdrawn. And I beg to retort that the American sports dittoes describe events in slangful, hysterical torrents of words, in the tones of an excited kid peeping through a knot hole in the fence. I get rather tired of all that "Say, folks" stuff.

ARIEL.

THE B·B·C· INVESTIGATED

A FINAL SUMMING UP

By OUR SPECIAL INVESTIGATOR

For the past five weeks we have published exclusive stories about various important aspects of British broadcasting. Programmes, internal administration, the Regions, technical research—all have received their measure of attention. This week the conclusions at which our contributor has arrived are gathered together into one constructive criticism of the machine of broadcasting.

WE have seen how the experimental reorganisation of the B.B.C., introduced last year, needs to be modified.

The division between "executives" and "creatives" should be reconsidered. It just doesn't work, however impressive it looks on paper. The theory that administrators would provide a facilitating service for creators has been disproved in practice. Administrators, whether they like it or not, have become obstructors.

What Really Counts.

Procedure of check and counter-check has reached ridiculous limits. The programme builders should be restored to their full executive authority. The principle of organisation should be confidence in the individual. If the programme staff cannot be fully trusted, then they should be changed. Given confidence in the individual, then the organisation itself should be simplified.

The only thing that counts is the signal that is received in the homes of the millions of humble people up and down the country for whom broadcasting exists. If this fundamental thought is always present there need be little trouble about schemes of organisation.

Having humanised the organisation, let us revert to programmes. The main thing wrong is the tendency to stabilise and reluctance to get out of accustomed ruts. The apportionment of time in standardised divisions is wrong; each programme should be considered as a whole for the listening period from 6 o'clock to midnight.

The irritating intervals should be abolished. There is room for much neater and more compact arrangement without going to the snappy extreme of American practice. Alternatives are unsatisfactory; they should be more definite and continuous. Broadcasting should run from 8 in the morning until midnight.

Let the B.B.C. concentrate on microphone production, keeping the transmitters energised. Announcing should be less stiff. The idea of standardising English should be abolished. Let announcers speak cultivated dialect and, above all, encourage them to be less formal.

Scrap the "Elephants."

The bias towards education and uplift should disappear. It would be an important and perhaps a decisive step in this direction if the two "Central Elephants" were scrapped. I mean the two pontifical and dreadfully respectable advisory educational councils, the one dealing with adult education and the other with schools.

Perhaps the latter could be spared, because, after all, the school transmissions do not invade peak listening periods. But there is no case for the former. The reason for starting it was to put the B.B.C. on the map among highbrows and educational pundits generally. It has long since outlived its usefulness and is now a definite menace to the programmes.

Gillie Would Show Them!

With this Council out of the way the B.B.C. would be free to deal with the real function of entertainment. Talks, no doubt, always will be with us, but they need not be dull. I think it would be a good plan to put the talks under Eric Maschwitz, the Director of Variety, who might do much worse than appoint Gillie Potter Director of Broadcast Education! Incidentally, there would be much more real education diffused than at present.

The Empire service needs reinvigorating. Malcolm Frost, the B.B.C. "traveller," who has been selling recorded programmes all over the Empire and the United States, has much practical experience of what the listening public overseas really wants. I would let him revise all the programme arrangements. The B.B.C. is spending about £40,000 a year on the present Empire service. Another £20,000 a year properly spent would make a vast difference. Also there should be much more enterprise and brightness in the presentation. Overseas listeners compare British programmes chiefly with American and Dutch competitors, who seem to make better use of inferior programme material.

Strengthen the Regionals.

The B.B.C. Regions need strengthening. They are admirably staffed, their chiefs being better qualified to build programmes than most of their colleagues in London. But they are starved of money and facilities. Regional programmes have been steadily becoming Londonised. About fifty per cent of their contents comes from the metropolis.

This is all wrong. Regions should be allowed and encouraged to put out really full-sized distinctive programmes. Not only would this mean a more varied and better service generally; it would give just that degree of competition that is now so sadly lacking.

In the old days, when there were about a score of stations, with perhaps half of them building their own programmes, there was something of the zest of real competition. Conditions now are much more favourable for this. The Regional transmitters are heard all over the country and far beyond. Each should develop its own tradition.

The B.B.C., as a whole, is well staffed. Once the over-emphasis on "organisation" is removed, the young and ambitious programme builders can be given their heads. And there should be new blood infused constantly.

They're Too Genteel.

Broadcasting House is not adventurous enough in its policy of staff recruitment. Over a year ago it was announced that the B.B.C. was on the look-out for a "reserve corps of bright young men and women" to be trained for jobs. So far as I can discover, the thing did not get beyond the good-resolution stage. There is too much "Is he a gentleman?" touch about the requirements. It would be better for broadcasting not to have so many "gentlemen" about.

On the money side the B.B.C. should be much more active than it is in trying to get the Treasury to disgorge more of the

(*Continued on page* 74.)

THE NEW DIRECTOR OF EDUCATION?

"I think it would be a good plan," says our contributor, "to put the talks under the Director of Variety, who might do much worse than appoint Gillie Potter Director of Broadcast Education!" Here you see Mr. Potter in one of his characteristic Hogsnorton attitudes.

SUGGESTIONS FOR BETTER RESULTS

Tips that you will find helpful.

CURING MODULATED HUM.

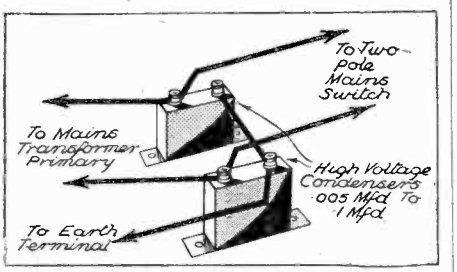
ANY good A.C. mains operated set can be expected to give satisfactory hum-free reception. Occasionally a peculiar form of hum is experienced, and it is distinguished by the fact that it is only heard when a station carrier is tuned in.

This is usually termed "modulation hum," and is frequently caused by a long or inefficient earth connection.

If the earth cannot be improved the trouble can usually be cured by connecting two high-voltage-type fixed condensers of ·005- to ·1-mfd. capacity in series across the A.C. mains input, the centre point of the two condensers being connected to the earth terminal.

When these condensers are added the mains switch should be of the two-pole type and should be connected between the mains input and the leads to the transformer and condensers.

A DOUBLE "BY-PASS"

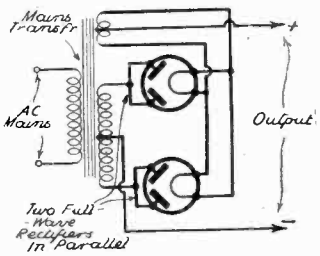


The condensers are in series across the mains with their centre point earthed.

PARALLELING RECTIFIERS

WHEN it is necessary to use more than one full-wave rectifier valve in a mains unit it might appear that the obvious way to do this would be to connect two similar valves in parallel. Now, although results *can* be obtained with this

FOR MORE POWER



The best way of using two rectifiers in one unit.

arrangement, it is really very bad practice.

If the rectifiers are connected in this manner and one has a slightly lower impedance than the other—it is almost impossible to get two specimens exactly alike—it will take a heavier load. And eventually the lower impedance valve will take *all* the load, with detrimental results.

On the other hand, if the two rectifiers are connected in the manner shown above they at once become a pair of single-wave rectifiers, the loading being equally divided between them.

TESTING TRIMMING.

SOMETIMES it is difficult to tell when the trimmers of a gang condenser are adjusted to the best setting, and also whether the tuning is double humped—an undesirable condition if at all pronounced.

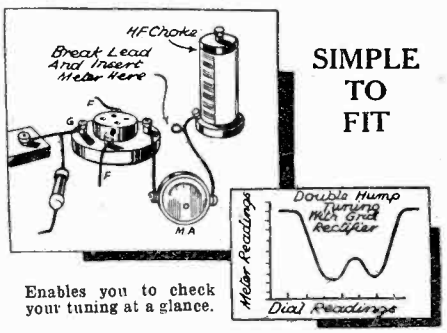
A milliammeter reading 0 to, say, 5 milliamps, connected in series with the anode of the detector valve, will soon show how the trimming and tuning is "going on." Its reading will drop, with grid rectification, as the best position of each trimmer is found.

The tuning can be checked by noting the meter's reading as the dial is moved across the tuning position of a certain station. If the reading falls to a certain value, rises well above this value and then drops again, double-hump tuning is present.

Just a slight rise in the middle does not matter very much if the circuit is of the bandpass type. (With an anode-bend rectifier the readings will increase instead of decrease at maximum tune.)

Incidentally an article on visual tuning methods appeared in "Popular Wireless" for February 24th.

SIMPLE TO FIT



Enables you to check your tuning at a glance.

TWO ENTHUSIASTS TRY FOCUSED RADIO

An account of first experiences with the "Bifocal Three," the set which incorporates the greatest advance of recent years in receiver design.

TO-NIGHT is the exciting night. Yesterday evening my brother and I put the last connection in place on our "Bifocal Three," and now, having arrived home with the valves, we are itching to get our fingers on those two magic knobs.

The set looks a real beauty, and the faithful old friend which it is to replace is pushed away in a corner. It looks quite resigned to its fate, as though it knows full well it is a back number unable to cope with modern conditions.

The Great Moment Arrives.

Well, here goes. First of all the aerial and earth leads. Now the L.T. and next the H.T. Thank goodness we shall not have to buy new high-tension batteries so often now, due to the Westector economiser scheme.

On goes the last battery connection, G.B.—. (How strange it seems to be applying such a high voltage! Somehow it brings home the fact that really high-powered reproduction is now at our disposal.)

Last of all, there's the loudspeaker, giving a slight click as its connections are made. The valves are inserted in a moment.

By Jove! Our hands are shaking with the immensity of the moment, and we literally hold our breath as we reach out for the on-off switch.

Click! Silence! We wait a moment to make sure the pentode has warmed to its work. Still silence!

Visions of hours spent in fault-finding rise up in our minds. But wait a moment: the tuning condensers are out of step. Eagerly we turn them and immediately hear stations, foreigners, one after the other, and then the local—a stentorian voice intoning the second news bulletin. What quality! And what selectivity that we should hear nothing simply because the dials were a little out of step!

The fact that the set has worked right away from the first try does not receive much thought from us. After all, we are used to this, for our previous sets have all been from designs set out in POPULAR WIRELESS, and we always make a definite point of keeping exactly to specification.

Fascinated by the sensitive feel of the set, we swing the dials backwards and forwards, revelling in the amazing number of stations rolling in—French, German, British, Russian, in fact all Europe is represented.

Shuts the Door on Interference.

Thought of Europe reminds us of the article in POPULAR WIRELESS for March 10th, "Europe in Focus," and then we realise that the focusing knobs are right out and therefore giving least selectivity. We also realise that many of the stations have been coming in on top of one another. So we hasten to "be wise and focalise."

Selecting a spot of jazz that is coming through with an accompaniment of guttural wordage and soprano singing, we push in the two focusing knobs. The next moment we know that all the claims made for the "Bifocal Three" are more than justified.

The result is like opening the door of the room in which the dance music originates, going in and closing the door after us. The latter effect is produced by a little touch on the reaction condenser (previously set at zero) which brings the wanted music, now clear from all interference, up to full loudspeaker strength.

A New Experience.

It's all so simple, and we needs must play with the controls like a child with a new toy. It is a new experience for us—we are masters of the European ether.

Even stations formerly unobtainable come in with clearness and strength. Never before have we been so astounded by a single improvement in receiver design.

On the long waves the effect of focusing is similar, and we would be content to go on picking out station after station and then bringing it into focus. But the evening is well on its way, and "Here comes Charlie," so we bow to the wishes of the remainder of the family and tune him in.

Even so we do not cease to marvel. Such quality, such volume! What wonderful times we can look forward to!

Thank you, POPULAR WIRELESS; and thank you, the British Radio Industry.

C. M.

RADIO DRAMA and the ORDINARY LISTENER

By JOHN C. ROBINSON

In order to assist readers who are entering for the Radio Play Competition, POPULAR WIRELESS has published several articles by experts dealing with different aspects of radio drama. This week "An Ordinary Listener" has been asked to give his views—views which are of interest to every radio enthusiast, whether or not he has entered the competition.

I SUPPOSE, strictly speaking, I am not an "ordinary listener." My wife, who has suffered radio long and patiently, often calls me a most extraordinary listener. At the same time, by the accepted standards, I suppose the B.B.C. Drama Director would regard my listening activities with favour.

I take no credit for the fact that I try to reproduce in my own sitting-room those aids to the enjoyment of a play which the theatre presents to all its patrons.

My chair is a comfortable one. The lights are turned down a few minutes before the time of the play. You see, I enjoy my radio plays. I am ready to listen to anything which may be produced—tragedy, history, even comedy.

One thing only I ask. After I have taken the trouble to put myself in a receptive mood, to follow the instructions and suggestions given me for ideal listening, I do want the author of the play to make some effort on his part to create for me an atmosphere which I can turn to some account.

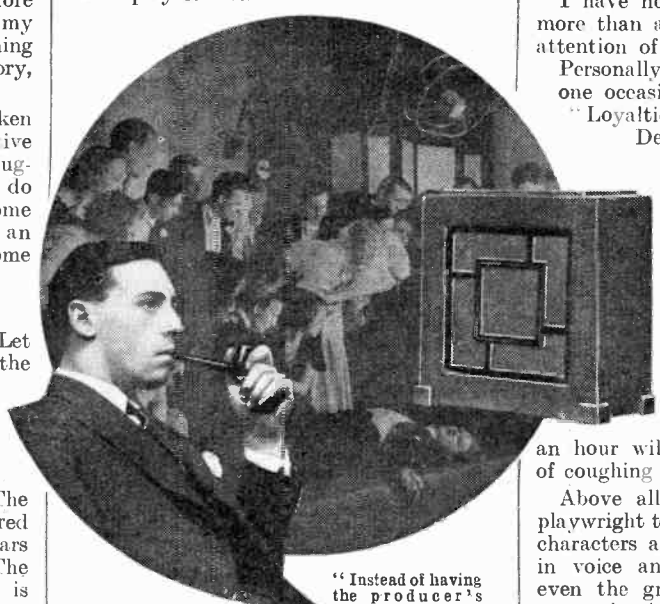
Radio Drama's Great Advantage.

Perhaps I don't make myself clear. Let me explain further. When I go to the theatre and look at the programme of a new play I form my own ideas of what the scenes will be like and, to a slightly less degree, what the actors will look like. When the curtain goes up I am often disappointed. The "glade in a wood" which I had pictured to myself so clearly and in detail appears like no grove I have ever seen. The "lonely cove on the Cornish coast" is made to look like a fashionable watering-place in the South of France.

Here radio drama, as I see it, starts with a great advantage. Instead of having the producer's conception of a scene thrust upon him willy-nilly (as in the theatre), the radio listener is in the happy position of being able to build up his own scene for himself as he would like it to be. The mind's eye is a useful thing!

Full Play to the Imagination.

And so I would ask the author of a radio play to give me the merest indication of what he wants his scene to be. He can do it by means of "effects"; by part of the dialogue. I leave it to him, but I do *not* want a narrator who tells me in detail what the author thinks the scene should be. If my imagination is not allowed full play, then the greatest appeal of a radio play is lost.



"Instead of having the producer's conception of a scene thrust upon him willy-nilly (as in the theatre), the radio listener is in the happy position of being able to build up his own scene for himself as he would like it to be. The mind's eye is a useful thing!"

The same reasoning applies—though, perhaps, not quite so strongly—to the characters in the play. To some extent, of course, our conception of a character must be limited by his voice or by the things which the author puts in his mouth. But even here our imagination should be allowed a little latitude. Let every would-be author of radio plays avoid the stage direction which reads: "he is a small man, growing bald with his fifty years. He stoops slightly, though he wouldn't admit it, and wears a black overcoat and bowler hat."

How long can I listen? Here I speak not only for myself, but as a result of long experience in giving "listening parties" to many of my friends.

I have never yet found a play lasting more than an hour receive the undivided attention of more than half its audience.

Personally, I have managed on more than one occasion to listen to the very end. "Loyalties," "Obsession" and "Wild Decembers" are cases in point.

Patience and Concentration.

But as a general rule I would lay it down that no radio play should last for more than forty-five minutes. Those whose patience and concentration are strong will wish for more, which will do the dramatist no harm. Those who cannot, in the ordinary way, last out more than an hour will not have reached the stage of coughing and shuffling feet.

Above all, I would beseech the radio playwright to keep down the number of his characters and to make them so different in voice and manner that no one—not even the greatest dullard among listeners—can be in any doubt as to who is speaking.

Up to now many radio playwrights seem to have disregarded these obvious listening facts. I suppose they will do so in the future. But I have a feeling I shall listen to their plays all the same. Radio drama is great fun.

THE "POPULAR WIRELESS" FIFTY POUNDS PRIZE

"POPULAR WIRELESS" offers a prize of £50 to the reader who, before March 31st, sends an original radio play which, in the opinion of the judges, is the best submitted. The B.B.C. undertakes to produce and broadcast the winning play. There are no irritating restrictions, and the few simple rules were published on page 29 of last week's "POPULAR WIRELESS." Please note that your entry must bear a postmark not later than midnight of Saturday, March 31st.

THE "TEN-YEAR" CLUB

Exclusive details of a select band of B.B.C. officials, together with other interesting news from Broadcasting House.

By O. H. M.

THE small but gradually growing band of "Ten-Yearites," meaning those who have completed ten years' consecutive service in the B.B.C., are forming a club. Sir John Reith is senior by a fair margin with his twelve years or so. Sir Charles Carpendale, the brothers Wade, Captain Chilman and Percy Edgar are in the next batch. Then come Mr. Roger Eckersley and Commander Val Goldsmith.

It has become the custom for each official to entertain on the occasion of the tenth anniversary, which the B.B.C. marks by a grant of special leave and a small bonus.

The Colonel and the Programmes.

Now that Mr. Roger Eckersley has gone to America for a prolonged absence, Colonel Dawnay becomes Director of Programmes, in addition to his previous function of Controller of Programmes.

Just what the distinction of duties is I cannot say, but one thing is certain, and that is that the personality of Colonel Dawnay will be much more decisively implanted on the programmes.

With Mr. Charles Siepmann, the Talks Director, also on the other side of the Atlantic, attending an education congress at Columbus, Ohio, the direction of talks, too, will devolve on the colonel.

Politicians and the Talks.

By a curious coincidence both the Conservatives and the Labour Party have set up private committees to study what the B.B.C. is doing in politics and to suggest changes if necessary. There is a feeling at both extremes of politics that it might be better for all concerned if there were more uncensored debates and fewer "middle" talks.

There is, indeed, a strong probability that the two committees will reach much the same conclusions. This will provide a valuable lead for a Government inquiry later.

Television Grievances.

There is a good deal of organised agitation against the decision of the B.B.C. to ease off on low-definition television. But I have it on the best authority that Broadcasting House will not yield.

This determination is concentrated in Sir Charles Carpendale and Mr. Ashbridge, the Chief Engineer, both of whom are anxious to liquidate television liabilities as soon as possible. They claim the support of the best independent technical opinion.

The Board of Governors.

In view of a recurrence of the rumour that there will be changes in the personnel of the B.B.C. Board of Governors at the end of the present year, I have made careful inquiries in Government circles and can say on the best authority that no changes are contemplated until it has been decided what to do with the B.B.C. after its Charter lapses at the end of 1936.

This, however, does not allow for resignations; but I have yet to hear that any of these are contemplated.

Talks by Unemployed.

An important series of talks which will throw a new light on unemployment is to be given at regular intervals throughout April, May and June. The talks will be given by unemployed men and women, and will be chiefly directed upon how they spend their enforced idleness and what they are doing to adjust themselves to the hardships and anxieties of their plight.

The series will no doubt cause a stir, and should result in some considerable interest in the work of voluntary social service, about which the Prince of Wales broadcast some time ago.

Detector Van in East Midlands.

The Post Office is going to have its little April joke by sending its detector van to the Nottingham, Mansfield, Newark, Grantham, Loughborough and Derby districts.

Wireless pirates in these localities are hereby warned to have their joke on the P.O. by taking out a licence. It's cheaper to pay 10s. at the post office than £2 to a magistrate, apart from the satisfaction of letting the P.O. sleuth hounds waste their time searching for somebody who does not exist.

YOUR PROGRAMMES ARE HERE!

Somewhere in this maze of cables which is being moved to make room for the new Underground Railway station at Holborn, London, are the all-important B.B.C. telephone circuits! Actually 70,000 telephone circuits in 100 cables are involved, and during the alterations not a single circuit will be interfered with or put out of service.

The Red Marley Contests.

Since 1928 members of the Birmingham Motor Cycling Club have spent their Easter Monday holidays in competing a freak hill climb at Red Marley. This is not a long way from where the famous Shelsley Walsh hill climb for motor cars is held in Worcestershire.

This year the Red Marley contests will be the subject of a running commentary by Major Vernon Brook, who is an expert in giving this type of broadcast.

The commentary will be included in the National programme, and listeners will be able to share the thrills of possibly ten thousand spectators as the motor cyclists endeavour to negotiate the hill. This has no proper road surface, but some fearsome gradients, varying between one in ten to one in one and a half, which is steeper than most people can walk up, even on a dry surface and by digging their heels into the grass and loose stones!

There are certain to be spills, but motor cyclists were always tough sportsmen.

THE LISTENER'S NOTEBOOK

Observations on programmes and personalities in British broadcasting.

"BIG BUSINESS" justified its claim to be something bigger and better than the usual run of musical shows by several fundamental features. "Big Business" had a story to tell like that successful musical show of a few weeks ago, "Love Needs a Waltz."

These two plays stand in a class by themselves, because, unlike most musical shows—on the stage as well as on the air—they had something more than a flimsy story to link up the series of bright and tuneful musical numbers. There seemed to be something humorous about Mr. Rigby's particular line of business—the manufacture of roller skates.

* * *

The dialogue of "Big Business" contained an unusual number of good lines. There was a publicity man, of course. How frequently we come across this brand of funny man in the entertainment world these days! I know this is an age of publicity, but, seeing that the stage and the screen both claim him as theirs, it's no novelty to find him in a radio production as well. Between the three media we are getting our fill of the publicity man. However, I prefer him via the unvisual medium, for he isn't a picturesque figure as the theatre portrays him.

Mr. Charles Heslop scored a distinct success. For sheer hard work his part will take some beating. I was interested also to hear Pat Taylor—of Step Sister's fame—in the cast. I had really never heard her before—I mean as a danseuse.

* * *

A clever item from the North Regional was Mr. Dunning's skit entitled "Forty Years On." Mr. F. E. Nichols, as a doddering old gentleman in retrospective mood, gave an amusing account of the adventurous spirit of the "thrilling thirties." Of course, he was speaking in 1974. The turn was remarkable for its refreshing humour.

* * *

The Café Colette orchestra succeeds in chasing all blues away, though they become a bit exhausting before they are through with their programme. I like them, however, because their style suggests they aren't the least bit jealous of the Cab Calloways, the Louis Armstrongs and the Duke Ellingtons. I am with them entirely. We want melody and more melody. If Henry Hall is still in doubt about his anti-crooners I advise him to listen to Henri Leoni and Aranka von Major. He would see what I mean immediately.

* * *

The B.B.C. took elaborate precautions, in the next of the series, to prevent a repetition of the "undelivered broadcast address" sensation. Really, one can't blame them, for broadcasting would be an undignified and ungovernable affair if broadcasters habitually behaved as Mr. Ferrie did. Yet the censorship persists, and listeners to whom this censorship is irritating will see in the measures taken by Mr. Ferrie more than a little justification.

* * *

When a Sunday programme contains both a Shakespeare and an instalment of the "Pilgrim's

(*Continued on page* 74.)

WE CONTINUE

P.W.'s COMPLETE SURVEY OF MODERN TELEVISION

By G. P. KENDALL

THE general survey of television theory and practice which I have given in the previous articles in this series has now reached such a stage that I think the reader will feel it is time to pause for breath, so to speak. It is true that we have but skimmed lightly over the ground, but we have covered it after a fashion, and we are in a position to look round a bit and reflect upon the nature of the country we have seen.

This article is in the nature of a summary, for in it Mr. Kendall "pauses for breath" and briefly reviews the progress we have made in our survey of modern television methods.

With his usual genius for accurate compression, our contributor here manages to put the position into the proverbial nutshell.

Co-ordinating the Facts.

In the study of so large a subject one is apt to get confused by the mass of detail encountered unless a definite attempt is made to keep one's sense of perspective healthily at work, and I imagine a little help from me to that end will not be unwelcome to the reader who has made a conscientious endeavour to absorb all the highly concentrated information which I have been handing out for so many weeks.

There is another reason why it often pays to stop occasionally in the study of any rapidly developing art and make a conscious effort to co-ordinate the scattered facts which one has learned: in acquiring those facts one sees a good deal of the actual progress which is being made all the time, and if time is taken to reflect upon this side of the matter it is often possible to form interesting opinions as to the general direction in which that progress is moving.

I think it will have been apparent that the general trend of television research is at present following two main directions: one concerned with reception and one with the transmitting end.

At the receiver the great practical problem is undoubtedly to devise ways and means for obtaining a bigger and brighter picture, and we have seen many examples of the success which is being achieved. It is only a little while, really, since the practical limits of picture size were fixed by the dimensions of a little neon tube, and it was so feebly illuminated that it had to be observed in almost complete darkness.

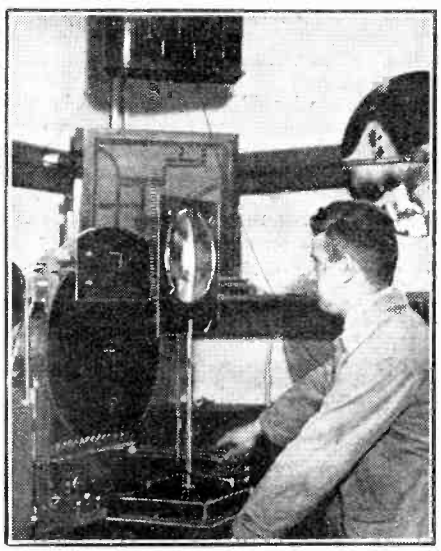
The Question of Size.

Now, the common size for the picture in receivers such as anyone can possess is three inches by seven, and it is sufficiently bright to be seen quite clearly so long as a very moderate degree of darkening is provided.

This advance is largely the result of the development of receiving systems using a very powerful local source of light controlled by some sort of valve which is operated by the television signals, a typical example being found in the combination of a high-power electric bulb (run from the mains) and the Kerr cell, or the more recent Okolicsanyi device.

On these lines active research is still proceeding, and I believe we shall see considerable further advances before very long. The ideal, of course, is a picture comparable in size and brilliance with that provided by a home cinematograph projector, and what I know of the work which goes on ceaselessly behind the scenes convinces me that the realisation of that ideal is not so very far off.

To be sure, a larger and brighter picture is not the only improvement we want to see: more detail and better definition are required, too. The results we now get are highly interesting, but the present amount of detail would probably be rather disappointing if it was regularly seen on a really large screen.



TO ENLARGE THE PICTURE

This German experimenter has mounted a large magnifying glass to increase the picture area, for, as Mr. Kendall points out, a great drawback of all the earlier apparatus is the small size of the received image.

Here we must turn to the transmitting side of the question, and we then find that we are up against what is really a *radio* problem. To get more detail we need more scanning lines on the picture, and it turns out that this in turn means a greater range of modulation frequencies in the transmitted wave.

A Difficult Radio Problem.

Unfortunately, such an increase is not permissible in a transmission on the present broadcast wavelengths, and so we find that the solution of the problem of a better picture by most of the existing systems is closely bound up with the exploration of new wavelengths for television.

Such exploration is proceeding, in this country, at the Crystal Palace, in Germany and America and elsewhere, and some very interesting results are being obtained. So far as the television apparatus is concerned, it is not unduly difficult to transmit and receive a picture with 120 or even 180 scanning lines, and such a picture is extremely satisfactory, giving really good definition and detail.

It is really a matter of finding a wavelength where such a transmission can be accommodated and which is capable of giving the desired results from a radio point of view. The search is a difficult and probably slow one, and there are those who consider that it is doomed to failure; but I notice that the people who are most closely concerned with it are also the most optimistic of final success.

The Search on Short Waves.

The subject is really a very large one, and I cannot hope to deal with it in any detail here.

The first experiments all tended towards really ultra-short waves of the order of seven to ten metres, but it now seems that the purely radio problems associated with such waves are so difficult that it may be some time before their true possibilities can be assessed. It appears, however, that there is considerable interest in waves around 50 metres.

A NEW LIGHT-CONTROL METHOD

Some further details of a recent American invention.

SOME few weeks ago I referred in these columns to a report I had received from an American source concerning an apparent improvement on the Okolicsanyi light valve. In this it will be remembered that it was claimed that the Nicol prisms of the original arrangement could be replaced by extensions of the mineral crystal and extra pairs of electrodes, a steady bias voltage being applied to these.

The scheme interested me, because I found it difficult to understand how adequate polarising effects could be obtained in this way. It now appears that it is actually very difficult, because I hear that one of the problems involved is to prevent the higher bias voltages from puncturing the thin plate of the mineral!

This would seem to suggest that the bias must be extremely high, probably running into thousands of volts, so I very much doubt whether the scheme has much of a future for amateur work.—G. P. K.

KIT KRITICISMS

The

TELSEN "323" KIT

By MR. PETER SIMPLE

THAT same extraordinary popularity of broadcasting which has seen the six million mark in licences reached and passed has brought with it a very natural demand for cheaper and simpler sets. Although the high-price level of commercial sets has been gradually dropping over the past years until an all-electric receiver of really reputable manufacture can be bought for less than a crystal set cost in the earliest days of POPULAR WIRELESS, there are still thousands of would-be listeners who must have something which costs not *comparatively* little, but really little.

That this means something which he can build for himself is obvious. The abolishing of factory costs is the first step towards cheaper radio in the home.

At the same time, the financial consideration is not always foremost in the mind of the man who sets out to build a kit set. There is a never-ending fascination not only in the actual process of building a receiver oneself, but also in the pride of owning and operating something which can be shown off to friends and neighbours with a well-justified "alone I did it"!

Obviously, then, it is no good a kit being cheap if it is not at the same time simple to build, simple to operate and satisfactory in its results.

Fulfils All Required.

Perhaps if one says that the Telsen "323" Kit is all these things it is the best praise we can give it. If any receiver fulfils all that is asked of it there can be nothing wrong with it either in conception or in practice.

But the "323" happens to cost only 29s. 6d., and because of this very fact there is a possibility that its merits may be overlooked.

There are several ways of building a cheap receiver—a receiver which costs less than thirty shillings. One way is to visit the side streets and markets and buy a lot of components from junk barrows. A bargain of any sort is beloved by the average Englishman. But a radio bargain is doubly enjoyed!

And what temptations there are! Transformers at half-a-crown, coils for a shilling or so, tuning condensers at a fraction of their original cost, valve holders for little more than a song. I once built a receiver for myself at a cost of less than twelve shillings in this way, just to prove that it could be done!

That, as I say, is one way. It is a very excellent way—if you just want to have the fun of building a receiver and don't worry about getting any results out of it.

But there is another way. And that is to take advantage of the years of patient and exhaustive research, of the months of practical experiment which go into the preparation of every receiver issued to the public by the house of Telsen.

A Guarantee of Efficiency.

Every separate part in the "323"—and there are some twenty of them—is manufactured by Telsen themselves, a guarantee not only of initial efficiency but of long and faithful service.

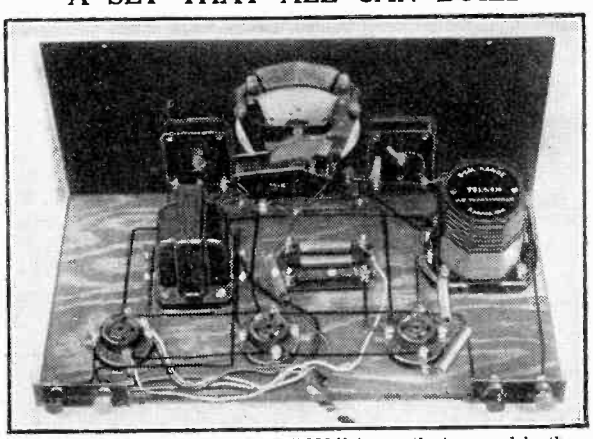
Just a word about the arrangement of the "323" circuit and the results which you may expect from it. It is a proved fact that a modern three-valve receiver, built with simple apparatus, gives a performance which surpasses the complicated and expensive multi-valve receiver with which constructors were struggling only a short time ago.

That is why Telsen have made the "323" a "detector and two L.F." circuit. A dual-range aerial coil, with which is associated the tuning condenser and an aerial series condenser for greater selectivity under exacting modern conditions, forms the first stage, while the detector is resistance-capacity coupled to the low-frequency stage. A transformer provides the coupling for the output stage.

Quality and volume, therefore, are the principal features of the design. The receiver is by no means limited to a few British stations. You will be able, under reasonable conditions, to secure quite a good bag of programmes. But as a result of my tests I am sure that also as a quality receiver on local programmes the "323" is going to please innumerable listeners.

Finally, let me point out that the entire construction of this receiver can be carried out in less than an hour, and that, when it is complete, it presents that well-finished appearance associated with a commercial instrument. The only tools required are a screwdriver and a pair of pliers, every part (and this includes wire and screws) is included in the kit, the blue print is clear and gives no opportunity for mistake, while, above all, no technical knowledge of any kind is needed. In short, this is a family receiver not only in operation but also in building. Young Horace will find it as easy as anyone else—though I doubt whether many owners will let the building go out of their own hands!

A SET THAT ALL CAN BUILD



The ease of construction of the "323" is greatly increased by the escutcheon assembly, front and back views of which are seen in the two pictures on this page. This photograph clearly shows the extreme simplicity of wiring which makes this new Telsen receiver a set that anyone can construct.

GOING—GOING—GONE!

A timely warning against rushing haphazard into the search for radio bargains.

A BARGAIN is dear to the heart of man. Quite often it turns out to be dear in a sadder sense of the word.

That twin condenser, looking so alluring and so cheap, may prove a snare and a delusion. Ganging may be a hideous, perhaps impossible, task. Those tempting coils, gaily placarded "Originally cost £2 10s. Sale price, 7s. 6d.," will go to swell your junk box.

Just reflect a moment. Wound to suit the valves and conditions of bygone days, the bogies of instability and bad selectivity are firmly entrenched. And, talking of valves, avoid the unknown valve like a plague, the motley collection one sees lying in window corners ticketed from 1s. upwards. The nameless valve is notoriously greedy, and, apart from doubtful results, you will soon pay the difference in L.T. and H.T.

Beware of Cheap Mains Parts.

Switches, again—but volumes have been spoken of and to these little pests. You can get a switch for 1d. I have seen them. What's more, I have bought one. It worked. The setting was hypercritical, but it did work—at one point.

If you are a collector of antiques it may be worth your while to inspect those transformers modestly hiding behind the loudspeaker. If not—pass on.

Above all, don't buy components for D.C. or A.C. mains, particularly the latter, on the cheap. It is simply courting disaster. If your pocket must be considered, a good plan is to choose the products of some reputable firm squeezed out of business by economic conditions.

Recently, out of curiosity, I chanced an old demonstration three-valve S.G. receiver. Excluding valves, its cost was nearer 10s. than £1. For quality and pep it was excellent. But it has one trifling drawback.

The spread of the "local," over 100 miles away, is 30 degrees on the dial. Have you ever visited the annual World's Fair? If so, you will have a rough idea of its performance.

Still, there is no need to be too pessimistic. Perhaps, in years to come, first editions of famous sets and components may be topping the list at Christie's.

E. O'M.

Recommended WRINKLES

WINDING SPACED COILS.

WHEN winding coils for radio work it is not always desirable for the turns to touch one another. A very good method of obtaining good even spacing between turns is to wind on a piece of string at the same time as the wire.

After the coil has been completed, the string can be removed and you will then have a nicely spaced winding. The

This diagram shows the method of winding string and wire on to a former to give equal spacing, the string being removed later.

distance between the turns will, of course, be approximately equal to the diameter of the string.

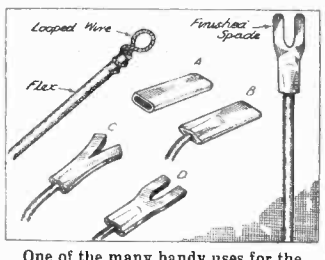
"TRANSPORTABLE" AERIALS

WIRE netting, suitably arranged, constitutes an excellent indoor aerial. The writer has in use a transportable receiver which is operated in one of several rooms.

To keep the receiver down to minimum size, the frame aerial was omitted and, instead, fine wire netting was tacked over the back of the sideboard in the dining-room and under the settee in the lounge. When the set is to be used in either room it is only necessary to connect the plug attached to the aerial terminal on the set to a socket fixed to the wire netting. *See also column three.*

NON-CORRODING SPADE TERMINALS.

VERY effective spade connectors for accumulator leads can be made up in a few minutes out of odd pieces of lead casing from ordinary electric light cable in the following manner:



One of the many handy uses for the lead casing of electric light cable.

ONE GUINEA FOR THE BEST WRINKLE!

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 1s. will be paid for the best Wrinkle from a reader, and others published will be paid for at our usual rates.

Each hint must be on a separate sheet of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear?

The best Wrinkle last week was sent by Mr. E. C. Nickson, of 132, Worsley Road, Winton, Patricroft, Nr. Manchester, to whom a guinea is being awarded.

Cut off pieces of the lead tubing, about 1¾ inches long, and brighten up the insides with a small file. The pieces will appear as A. Next, bare the end of the flex or rubber-covered wire to be used, make a loop, and insert about half-way into the lead tube, and flatten the latter with a hammer or pliers, as shown at B. This will securely grip the flex, at the same time making perfect electrical contact with the wire loop.

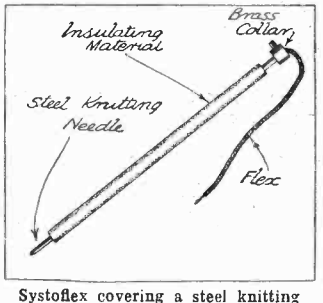
Then, with a pair of scissors or snips, make a cut about ¾ in. long, as at C. Bend the two sections in to form a spade (D). Smooth off the rough edges with a file, and the connector is complete.

SIMPLE TESTING PRODS.

METAL prods are invaluable for testing purposes, since with a completed set it is rarely that one's fingers can be got into the nooks and crannies.

When the circuit is being tested for continuity some means of making contact from point to point is essential.

A very effective pair of suitable prods can be improvised from a couple of steel knitting needles. A length of systoflex or similar insulating sleeving



Systoflex covering a steel knitting needle makes a useful testing prod.

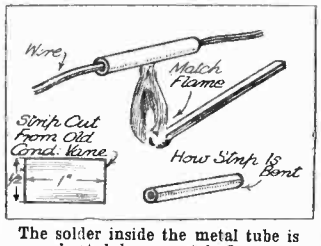
on each will ensure that no short-circuits can result, and to make a neat job for a permanent pair the ends of the sleeving can be bound with thin wire.

Flex wires can be attached to one end of each prod by means of small brass collars, such as are used for coupling switch spindles.

SOLDERING WITHOUT AN IRON.

HERE'S a tip for soldering together two wires when a hot soldering iron is not at hand:

Bare and twist together the two ends of wire to be soldered, and smear the joint lightly with flux. Cut one or two little pieces off a stick of solder, and press them into the joint also. Next fit over the joint a tubulous aluminium shield which has been made from an old variable condenser vane. (See sketch.)



The solder inside the metal tube is heated by a match flame.

If a flaming match is now held underneath a fine connection will be the result.

AVOIDING UNSIGHTLY WIRES.

IT is not always necessary to erect a special aerial for a radio receiver. Very often a set is installed where it is inconvenient to fix an outside wire, and perhaps it is not desired to disfigure a room with untidy inside wires.

A very good substitute for an aerial can be obtained by connecting any fairly large unearthed metal framework to the set. A metal fender, a bedspring or any similar framework will suit quite well. It should be connected to the aerial terminal of the set in the same manner as an ordinary antenna.

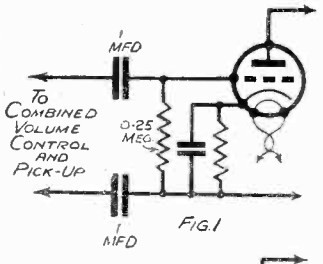
ALL-WAVE TUNING.

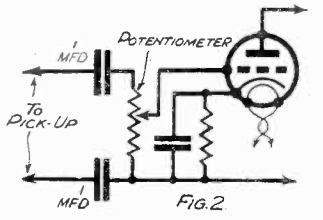
RECENTLY the writer had occasion to dismantle his S.G. three, using ganged condensers, in order to build an all-wave straight three, using six-pin coils. To get over the difficulty of the difference in maximum tuning capacities needed on the ordinary and short wavebands, he utilised the ganged ·0005 condensers in rather a novel and certainly very useful way. The two sections of the condenser were simply connected together in series, and a shorting switch arranged on the panel to remove one of them from the circuit at will. In this way, with only one tuning dial, the maximum tuning capacity may be varied from a very useful ·00025 on the short waves to the usual ·0005 on the medium and long waves.

THE PICK-UP AND D.C. MAINS.

IT is advisable completely to isolate the pick-up from all D.C. potentials when working on D.C. mains. Using normal connections, the pick-up leads, and often the casing of the pick-up, are at the same potential above earth as the negative mains lead.

Consequently, when the positive main is earthed there is a potential difference between the pick-up and earth of the full mains voltage. If by any chance the pick-up and some earthed object are touched at the same time a shock will be received.





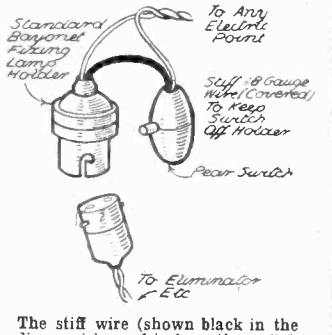
By using the condensers shown in this diagram a pick-up can be dis-associated completely from D.C. mains.

Any chance of this happening can be overcome quite simply. Fig. 1 shows the circuit to be used when the volume control is combined with the pick-up. The circuit shown in Fig. 2 should be used when the volume control is on the amplifier. The value of the potentiometer should be that recommended by the makers of the pick-up.

HANDY SWITCHING.

MOST wireless enthusiasts want a light or electric point for eliminator, electric soldering iron or for some experiment, and when they do not desire to go to the expense or bother of fitting wall switches, etc., the following idea is useful.

A pear-type switch is wired in series with a lampholder, as shown in the diagram, one connection being of stiff rubber-covered wire to hold the pear switch and holder apart.


Standard Bayonet Fitting Lamp Holder
To Any Electric Point
Stiff 18 Gauge Wire (Covered) To Keep Switch Off Holder
Pear Switch
To Eliminator or Set

The stiff wire (shown black in the diagram) is used to keep the switch clear of the lampholder.

HOW GOOD IS YOUR VALVE?

The method of calculating the mutual conductance, or "goodness factor," of a valve is given this week as part of our Beginners' Supplement. Other useful radio terms are also lucidly explained

By G. V. DOWDING, Associate I.E.E.

Mutual Conductance.

It is this which indicates the "goodness" of a valve and is the ratio of the change in plate current to the change in grid voltage.

It is the purpose of at least all amplifying valves to provide as large a change of anode current for a given grid-voltage variation as the conditions permit.

The amplification factor denotes the theoretical maximum of amplification possible with a valve, but, generally speaking, the higher the impedance for a given amplification factor the smaller will be the proportion of this theoretical amplification that is obtained in practice.

This will be clearly understood when it is realised that the impedance of the valve has to be "matched" by the external circuit, and that there are numerous restrictions on this latter.

It will also be easy to see that for a given amplification factor the lower the impedance the greater the mutual conductance, or grid-plate transconductance, as it is sometimes called.

GLOWING TESTIMONY

The many uses for a neon lamp (seen here in an ordinary lamp-holder) depend upon its curious property of glowing and becoming conductive only when the impressed voltage reaches a predetermined value.

The relationship between these three factors is, then, a straightforward one. A rough calculation of the mutual conductance of a valve can be made by multiplying the amplification factor by 1,000 and dividing the impedance into this.

Thus a valve has an amplification factor of 18 and its impedance is 12,000 ohms. 18 multiplied by 1,000 equal 18,000. This, divided by 12,000, is 1·5, and that roughly is the mutual conductance.

Often the mutual conductance appears in this manner: Mutual conductance—2 mA./V.

Interpreted, this means "two milliamperes per volt." In other words, a variation of grid voltage of 1 volt produces an anode-current change of 2 milliamperes.

It should be noted that "mu" is not an abbreviation of mutual conductance, but that it refers to amplification factor. Mutual conductance is usually denoted by Gm. or just "G."

It is the best single factor for judging the goodness of a valve, but it should not be indiscriminately used as a basis of judgment.

Mutual Inductance.

The degree of coupling that exists between two coils.

Natural Frequency.

The frequency at which resonance occurs in a circuit containing inductance and capacity; the frequency at which the circuit naturally tends to oscillate.

Likewise, the natural wavelength of a tuned circuit or of an aerial is that wavelength at which oscillation most readily occurs by virtue of the particular capacity and inductance that are present.

The term natural frequency or natural period is also mechanically applied. For example, if a loudspeaker diaphragm is said to have a natural frequency of 600 cycles it is at that frequency that it will tend most easily to vibrate.

Negative Pole.

A point at which exists a superfluity of electrons. Electrons, therefore, tend to flow from a negative pole to a positive pole, for the latter term indicates a point that is relatively deficient of electrons.

According to the old theory, electrical current flows from a positive to a negative pole, but the modern electron theory maintains that the flow is in the reverse direction.

Neon Lamp.

A device that has many electrical and radio uses. It comprises a glass bulb filled with neon gas and containing two electrodes.

At a certain voltage current passes between the electrodes, and a glow is caused.

The intensity of the glow will vary as with differences in the applied voltage, and this is made use of in television in order to transform voltage variations into light fluctuations.

As a neon lamp will not glow at all before the voltage across its electrodes reaches a certain value it can be employed as a visual indicator for various special purposes.

For instance, it can be included in a tuning circuit to indicate when the current in it rises to a maximum point and resonance exists. One application of this idea is the neon lamp wavemeter, often used for checking transmitters. Another, the tuning indicator on receivers that shows when a station is tuned in by a small neon lamp glowing.

Neon lamps are also used as voltage stabilisers in mains units and in various forms of testing apparatus.

Ohm.

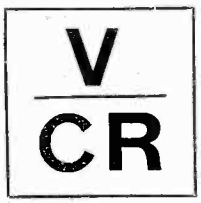
The unit of resistance.

Ohm's Law.

The most fundamental law of electricity, and fortunately one that is very simple. It epitomises the relationship between current, voltage and resistance in a circuit.

It can be expressed as:

Current (in amperes) = Voltage (in volts) / Resistance (in ohms).



A simple method of calculating voltage current, or resistance, provided two of the three factors are known. An explanation of the use of this diagram is given in the text.

From this it will be seen that, providing any two of these factors are known, it is easy to work out the other. The centre figure illustrates this clearly.

The letter indicating the unknown factor should be covered with the finger, and then the other two show the calculation necessary. Thus, to find current, cover the "C" with the finger. This leaves V divided by R.

To find voltage, cover the "V" with the finger. CR is left, and that is the arithmetical expression of C multiplied by R.

Working must always be done in volts, amperes and ohms, and milliamperes, megohms and other such units must accordingly be translated before the law is used.

The following are some examples of Ohm's Law:

1. A resistance is included in a circuit, and it is desired to know what voltage drop occurs across it. The resistance has a value of ½ megohm. It is discovered that the current flowing through it is ·1 milliampere.

Ohm's Law states that voltage equals current multiplied by resistance. Therefore we multiply 500,000 (for ½ megohm is 500,000 ohms) by ·0001 (being .1 milliampere expressed in amperes).

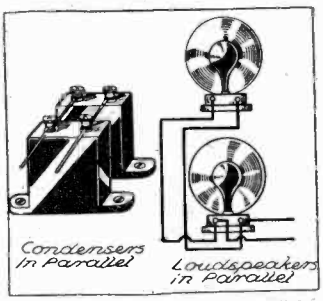
The result is 50. Thus 50 volts are "lost" in the resistance.

2. The filament rating of a valve is 2 volts, ·1 ampere; what is the resistance of the filament?

Resistance equals voltage divided by current.

Therefore we divide 2 by .1, which is 20, and that is the resistance in ohms.

IN PARALLEL



Illustrating the meaning of parallel connections. In the two examples shown each component provides an independent path for the current.

3. A resistance of 500 ohms is connected across the terminals of a 2-volt secondary cell (accumulator); what will be the current flow?

Current equals voltage divided by resistance.

2 divided by 500 is ·004. The current flow will be ·004 amperes, and that is 4 milliamperes.

Open Circuit.

A broken circuit; a circuit that is incomplete and through which current cannot flow.

Oscillation.

Electrical vibration; the flow of high-frequency current in a circuit. When the power supplied is not sufficient to make up for the wastage of the current in heat while overcoming the resistance in the circuit, the oscillations die away or, in other words, are "damped."

If the wastage is made up the oscillations will be maintained, and this is what happens in a valve receiver when the reaction coil is closely coupled to the grid coil.

Oscillatory Circuit.

A circuit containing inductance and capacity and not more than a given resistance (dependent upon the resistance and capacity).

Such a circuit will oscillate at its natural frequency when supplied with energy from an external source.

The tuning circuits of a radio receiver are oscillatory circuits, and variable condensers are employed to vary their natural frequencies.

Continuing his search after quality reception, our Chief Radio Consultant explains how, in certain cases, a receiver designed to receive the carrier and only one set of sidebands from a "wanted" station can cut out "monkey chatter" and heterodynes.

SO last week you got the appearance of the European ether! In case your memory is week by week anæsthetised, let me tell you again what we found out. I expect the most compact revision of the facts is contained in Fig. 1.

Here you see a picture (purely imaginary) of a mass of stations spread over the frequency gamut. The technical committee of the European Union have arranged them to be much too close together—9 kc. apart.

The Perfect "Window."

When you "tune" you really slide a window across the spectrum. In Fig. 1 (b) I show this. I show a perfect "window"—no halation occurs, only the wanted light shines through.

"But not by tuning windows only comes the light." "Unwanted stations shine through . . . and they might!" See Fig. 1 (c), showing how some other stations shine through. The whole problem is to design a receiver which accepts all the wanted-station carrier and sidebands and rejects all others.

Now, I showed last week that you *might* get a weak unwanted station next to a strong wanted station, but a strong unwanted on the other side of the wanted.

If you could devise a receiver with a window only half as wide as the window in Fig. 1 (b), then you could accept the wanted-station carrier and *one* set of sidebands, but you would reject those sidebands of the wanted station interfered with by the powerful unwanted.

Single Sideband Reception.

This so-called "single sideband reception" is only effective, of course, when the wanted station has one weak neighbour. But cases do occur where the wanted station is interfered with by only one neighbour, so that there is a practical value in the consideration of the hypothetical case.

Question: How can a receiver be designed to accept only one set of sidebands plus carrier? Answer: The superheterodyne receiver can be designed to accept only one set of sidebands plus carrier.

This is the real recommendation for this type of receiver. I see no other advantage. Permeability tuning, where the all-important ratio, coil inductance to coil resistance, is kept constant, achieves a perfectly uniform response over the whole waveband.

True, it introduces mechanical ganging problems, but also—and more so for perfection—does the superhet. There never was a purely technological problem that fails to get solved at long last. So I say: "Don't let's hold up the argument for detail."

Let's stick to the point that the superheterodyne can achieve, more easily than any other type of circuit, that desirable square-window tuning so narrow that it lets through only carrier and *one* set of sidebands (not carrier and *two* sets of sidebands) and as clear cut as in Fig. 1 (b).

You know why, of course. The superheterodyne works by introducing an oscillation of, say, 100 kc. difference frequency from the frequency of the wanted carrier and rectifying the component to make always that same 100 kc. frequency.

Thus, if the wanted station is 1,100 kc./sec. frequency, then the oscillation is made 1,200 kc./sec. (1,200 minus 1,100 = 100). If the wanted station is of 600 kc./sec. frequency, then the oscillation is tuned to 700 kc./sec. (700 minus 600 = 100).

A Constant Beat Frequency.

Thus, by adjusting the oscillator to be always *the same difference* frequency from the carrier of the wanted station, we get the same "beat" frequency set up (after rectification). This rectification is done in the so-called first detector. So this intermediate or beat frequency has always the same frequency—and it is a much lower frequency than the wanted carrier. There is thus the intriguing possibility of doing all the filtration at a fixed, same, invariable, inviolable frequency and to make that frequency low.

Thus a great difficulty—avoided in a superheterodyne—is to design sharp cut-off filters to perform their proper functions at different frequencies and to make them adjustable by one handle to those frequencies. It can be done, and is done well, by permeability tuners, but it can be more easily and better done at a fixed frequency.

Eliminating Heterodynes.

So that, if I were asked to design the perfect receiver, I would design it on the superheterodyne principle, because it would give me this facility of making a very good sharp "window." I can, in fact, make my window so narrow that it will accept only carrier plus one set of sidebands. And this may be a great facility, and will allow me to cut out monkey "chatter" and heterodynes.

Of course there are lots and lots of difficulties. I very much doubt if, in cheap commercial designs of superheterodyne receivers, the advantages I have outlined as possibilities can be realised as practice at the price. Perhaps, however, the user automatically adjusts his receiver to do the best possible. I don't know.

Thus our summary is that the super gives us, if properly designed and if properly adjusted, a new facility—that of single sideband reception. Next week I shall deal with the transmission end.

PROBLEMS OF TUNING

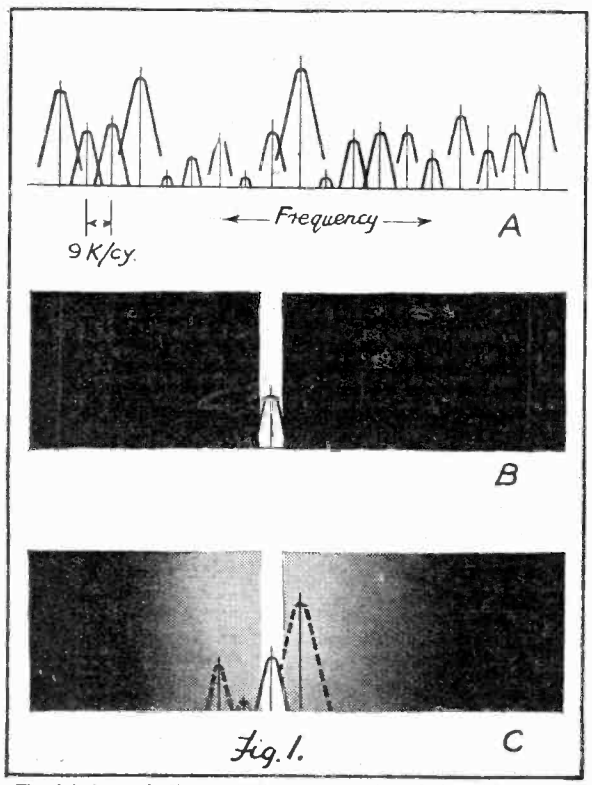


Fig. A is a rough diagrammatic representation of the state of the European ether with stations so close together that their sidebands must, in many cases, overlap. Fig. B is an ideal tuning "window" with the wanted station only appearing clear-cut in the opening. Fig. C is more akin to common practice with unwanted stations shining through on each side of the opening.

OUTSIDE "THE BIG HOUSE."

THE B.B.C. IN THE PUBLIC EYE

"SHOOTING" THE BROADCASTERS

Exclusive details about the new film of broadcasting.

"O. K. Cut. Save 'em." The giant arcs and flood lights of the studio are dimmed as the cameras stop clicking and the microphone is switched off.

"And now, Sir John," the director is saying, "we want a little more austereness in that scene where you are letting the rest of the B.B.C. Board know what you think about the latest indiscretions of the programme staff."

The B.B.C. is starring in a film to be made during the next few months and shown in the early autumn—and *is* this a brief picture of a scene at the film studios, or at Broadcasting House during the shooting of it? It is *not*.

When we heard that the B.B.C. was going to follow America's lead and be the star in a British "Big Broadcast" we shuddered.

Haunting visions swept over us of the Director-General hanging on to several telephones at once, the while he vigorously rolled chewing gum from one side of his face to the other and yapped down the phone to the various departments. It surely could not be true.

No Sloppy Sentiment.

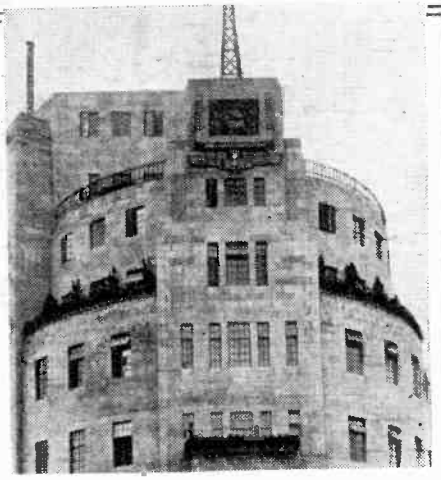
Yet the B.B.C. *is* to be filmed. That much is true. And the click of the cameras may even now be heard in the otherwise soundless corridors and rooms of the stately seat of British broadcasting. But of desecration there will be none.

No sloppy sentiment is to come into the story, and we suspect that even the Eight Step Sisters, should they appear, will be heavily veiled and most decorously covered!

But Henry Hall and his band will be well to the fore, having about 10 out of the total 50 minutes. The theme of the film is the history of the B.B.C. and there will be shots of the new long-waver at Droitwich.

The Post Office is making the film; it is to last about 50 minutes and will cost £7,000 or £8,000 to produce.

We are looking forward to the release; we want to see how the B.B.C. wishes to appear to the public it serves. We hope it will not be too coldly formal.



WHY TELEVISION LAGS BEHIND

Sir Ambrose Fleming criticises the monopoly of the B.B.C. as a drag on progress.

THE views of thousands of listeners were accurately expressed at the recent meeting of the Television Society in London, when Sir Ambrose Fleming referred to the B.B.C.'s attitude to television as "over-cautious and unenterprising."

There has long been a feeling among those whose entertainment comes, chiefly, from over the air that any chance television might have of being brought into the realms of "practical politics" is being minimised by the monopoly control—so far as public presentation is concerned—of the B.B.C.

"Television," said Sir Ambrose in his presidential speech, "has not yet had a fair chance to prove its entertainment value. There should be programmes at an hour when people want to listen. Television is in the grasp of the B.B.C. and its small group of Governors. Premature legislation can easily cripple a nascent industry and bind it in bandages of red tape."

It is interesting to note that Sir Ambrose, who for more than fifty years has been practically connected with all forms of sound transmission, should now be turning his attention so seriously to the transmission of light. He advocates an extension of the period of patent protection from its present 14 years, as well as a broadcasting court of appeal representative of the public.

* * *

THE CONTROL OF THE B.B.C.

Parliamentary protest against the present constitution.

THE rumblings at the foundations of the B.B.C. continue. Parliament has been talking about the complaints concerning the administration and the programmes that have been voiced abroad lately.

Mr. Holford Knight, K.C., has done much to bring the matter to a head, and with other members of the House has handed in a motion asking for the setting up of a Select Committee to investigate thoroughly the powers, administration, finance and expenditure of the B.B.C.

"The Charter expires in 1936," said Mr. Holford Knight, "and these things ought to be looked into well in advance of the expiry date.

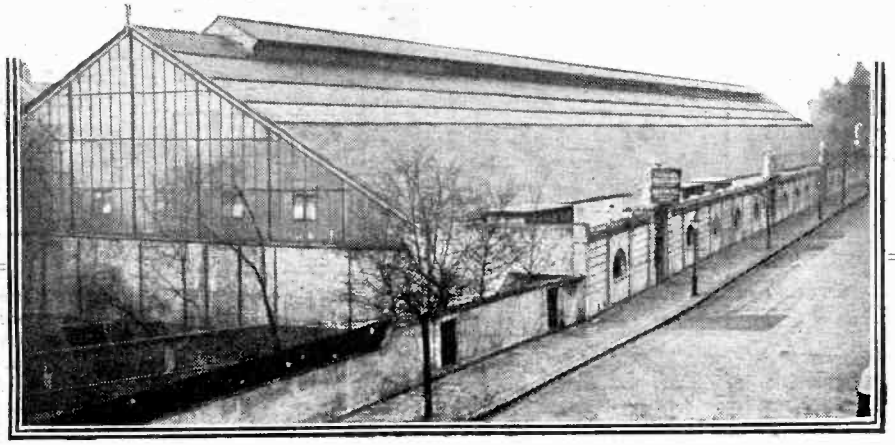
"So many complaints have reached not only the Press, but myself and other members, that the setting up of a Committee is a vital necessity. Obviously something is wrong with the B.B.C. for so many listeners to be dissatisfied.

"It is Preposterous."

"There is no question of the Charter not being renewed. I certainly do not expect Parliament to sanction the starting of any opposition broadcasting concern, as has been suggested, and certainly not any company organised by American interests. Such an idea is preposterous and we should not stand for it.

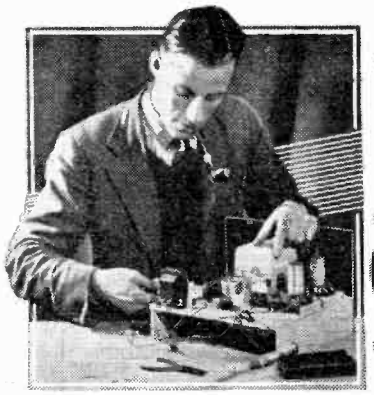
"We are not picking any particular holes in the B.B.C.; it is just a matter of a general overhaul of the Charter viewed in the light of the recent mass of criticism that has been levelled at the Corporation by British listeners."

In other quarters the storm against a "hush-hush monopoly," as the B.B.C. is called, is rapidly growing and is liable to break at any moment.



While critics inside and outside Parliament are hard at work pillorying broadcasting in its administrative aspects, the technical department of the B.B.C. continues to expand on all sides.

To the new research laboratories in Balham have been added the television studio in Portland Place and the old Maida Vale skating rink, which you see here before the engineers started on its conversion into the latest studio.



The CONTRA-PHASE 4

AN ABSOLUTELY UNIQUE FOUR-VALVER
of astounding range, exclusively
FEATURING—
AUTOMATIC QUIESCENCE CONTROL
for Economy.

* * *

CLASS B OUTPUT STAGE
for Power and Quality.

* * *

CONTRA-PHASE CONTROL of the S.G. Stage for using either 3 or 4 valves, as necessary.

Designed and described by
G. V. DOWDING, Associate I.E.E.

THE Contra-phase principle of economy has proved one of the most successful and popular ever introduced to "P.W." readers. Of that there is not the slightest doubt.

A very large number of constructors built the "Double X Three" in which the scheme first appeared, but an even larger number applied it to their existing sets.

It is not hard to find a reason for this; "Contra-phasing" saves money. Its first costs, the costs of including it in a set, are a matter of only two or three shillings, and these are very soon wiped off by the saving of H.T. that results.

"Electric Gearing."

But although, as I have said, many readers have added the system to existing sets, this is not a course we recommend. We prefer to see it introduced as an integral part of a design.

It requires only a couple of fixed condensers over and above the volume control, which would, in all probability, be used in any case.

It is, in fact, largely a circuital development and one that is as novel as it is effective and valuable.

Obviously, it is one of the special features of this "Contra-phase Four"—the name of the set indicates that. Many of you already know all about the scheme, but we have garnered so many new readers during the past few months that a few words of explanation are called for.

The object of the Contra-phase is to give the set a kind of electrical gearing.

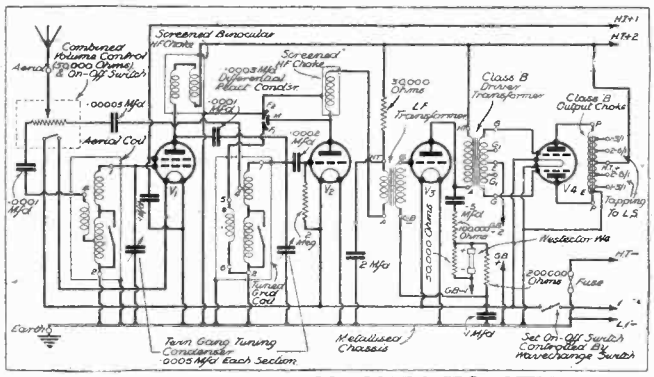
In the ordinary way a receiver works full out all the time, whatever the programme that is being received.

This is as bad as having a car of forty horsepower roaring away with the full strength of its forty horses at all speeds. Clearly, to use power in such a manner is decidedly uneconomical.

Considerable Economy Effected.

The Contra-phase control comprises a potentiometer with a switch mechanism incorporated in it. (A quite standard component, by the way.)

The potentiometer operates as a volume control, but in a very special way. It moves the aerial input of the set over from the S.G. valve to the detector, and at minimum the S.G. valve is automatically switched right out of action.



A CIRCUIT TO STUDY

The combined volume control and on-off switch (left) is the Contra-phase control that switches the input from the aerial either to the S.G. valve or direct to the detector. In this event the S.G. valve is automatically switched right off and uses no H.T. or L.T.
Note, too, the "Westector," which is used in an ingenious economiser circuit between plate and filament of the driver valve V3.
The last valve is one of the Class B type, with tapped choke output for matching your loudspeaker.

So the power of the set is exactly set for the requirements of the moment. Were the "Contra-phase Four" of normal design all its four valves would be in action for the reception of the local station as well as for distant listening.

If the total hours per month when the average set is used only for local reception were totalled up, it would be found that considerable wastage must occur by this extravagant method.

The Output Stage.

For local and other powerful station reception the screened-grid valve, with its none-too-light consumption of H.T. current, is usually absolutely unnecessary, and in such circumstances the "Contra-phase Four" becomes a three-valve set; but even then not an ordinary three-valve set, for the Contra-phase principle is extended.

There is a stage of Class B for great output and good quality at a low average H.T. As you will all be aware, Class B draws an H.T. current proportionate to the volume. When there are only quiet passages of speech or music the current is small, and it drops even lower during programme pauses.

With every increase of volume the current rises—but only in proportion. You pay for the volume that is delivered by the loudspeaker—not continually and all the time for the probable peaks which normally must be legislated for, but which, in practice, seldom occur.

Further Saving Accomplished.

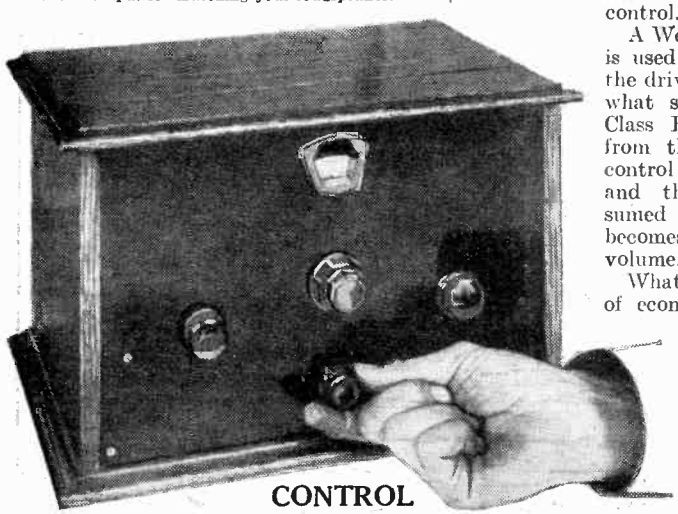
But our economy does not stop there. The driver valve, the L.F. valve which follows the detector, incorporates another "P.W." scheme—automatic quiescence control.

A Westector metal rectifier is used for this, and it makes the driver valve act in a somewhat similar manner to the Class B stage. The output from the driver is made to control the driver's grid bias, and the H.T. current consumed by this valve, too, becomes proportionate to the volume.

What a magnificent team of economy workers!

The Contra-phase control adjusts the sensitivity of the set, and, when it does not require the S.G. valve in order to pull in a station with the desired power, the mere act of adjusting

(Continued on next page.)



CONTROL

The vital Contra-phase control is placed centrally at the bottom. Above it is the tuning condenser, with reaction to the right, and the combined wavechange and on-off switch to the left.

THE "CONTRA-PHASE 4"

(Continued from previous page.)

for the volume and taking this down to minimum switches the valve out of action.

Meanwhile, and during the whole time the set is working, both the driver valve and the Class B valve (*both* of them, note) take only that proportion of H.T. current required for the volume the loudspeaker is delivering.

Yet the quality is unaffected. The same purity is there, whatever the dimensions of the sound waves created.

It may stagger some of you, but it is, nevertheless, an absolute fact that the "Contra-phase Four," at minimum sensitivity and for quiet passages of music, takes only a mere five milliamperes or so of H.T. current!

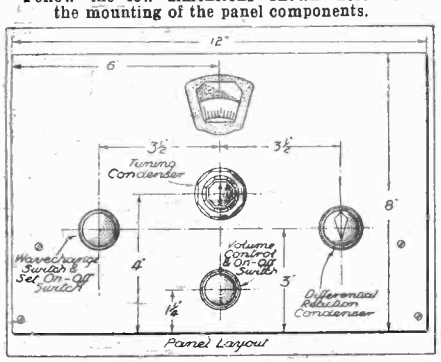
Handles Big Output Power.

And yet its power-handling capabilities are immense. It will work a large moving-coil loudspeaker and give "mains" results. And a touch of the Contra-phase control will make it spring into an abounding energy, with a sensitivity such that the far-distant transmitters are pulled in with uncanny facility.

Its selectivity is that of its coils—two screened units of modern design.

DRILLING THE PANEL

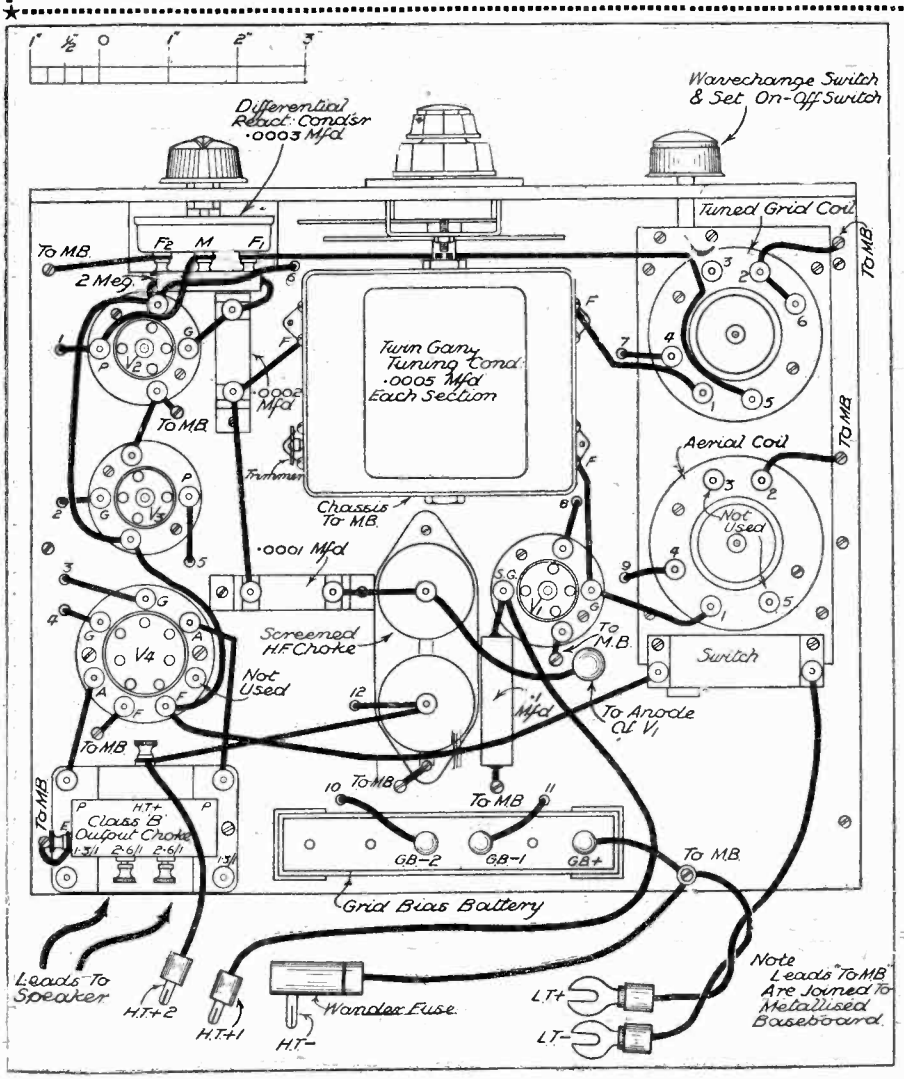
Follow the few dimensions shown here for the mounting of the panel components.



THE "CONTRA-PHASE FOUR" COMPONENTS—MAKES AND TYPES TO USE

- 1 J. B. Unitune 2-gang ·0005-mfd. tuning condenser.
- 1 Lissen 2-gang coil unit with on-off switch, type L.N.5161.
- 3 W.B. small-type 4-pin valve holders, or Telsen, Benjamin, Lissen.
- 1 W.B. 7-pin valve holder, or Benjamin, Telsen, Lissen.
- 1 Telsen screened binocular H.F. choke, or Graham Farish.
- 1 Graham Farish screened H.F. choke, type H.M.S., or Bulgin, Telsen, Wearite.
- 1 Telsen ·0003-mfd. differential reaction condenser, or Graham Farish, B.R.G., Polar.
- 1 R.I. Hypermite L.F. transformer, or Varley, Lissen.
- 1 Igranic Class B driver transformer, or Varley, Ferranti, Lissen, R.I., B.R.G.
- 1 B.R.G. Class B output choke, or Ferranti, R.I.
- 1 T.C.C. 2-mfd. fixed condenser, type 50, or Graham Farish.
- 1 Dubilier ·5-mfd. fixed condenser, type 4406, or T.C.C.
- 2 T.C.C. ·1-mfd. fixed condensers, type 250, or Dubilier.
- 1 Dubilier ·0002-mfd. fixed condenser, type 620, or T.C.C., Lissen, Graham Farish.
- 1 Dubilier ·0001-mfd. fixed condenser, type 620, or T.C.C., Graham Farish, Lissen.
- 1 Dubilier ·0001-mfd. fixed condenser, type 670.
- 1 Dubilier ·00005-mfd. fixed condenser, type 685, or T.C.C.
- 1 Graham Farish 100,000-ohm 1½-watt type Ohmite resistance in horizontal holder.
- 1 Graham Farish 50,000-ohm 1½-watt type Ohmite resistance in horizontal holder.
- 1 Graham Farish 200,000-ohm 1½-watt type Ohmite resistance in horizontal holder.
- 1 Erie 30,000-ohm 1-watt type resistance with wire ends or terminals, or Dubilier, Graham Farish, Bulgin, Varley.
- 1 Lissen 2-meg. grid leak with wire ends, or Varley, Bulgin, Erie, Dubilier.
- 1 Westinghouse "Westector," type W.4.
- 1 Bulgin 50,000-ohm potentiometer with on-off switch, type V.S.36.
- 1 pair Bulgin grid-bias battery clips, type No. 1.
- 1 Peto-Scott panel, 12 in. × 8 in., or Goltone, Permcol.
- 1 Peto-Scott Metaplex chassis, 12 in. × 10 in. with 2½ in. runners.
- 1 Bulgin twin-plug strip, type P.30A.E.
- 2 Clix accumulator spades, or Belling-Lee, Bulgin, Eelex.
- 5 Belling-Lee wander-plugs, or Clix, Bulgin, Eelex.
- 1 Belling-Lee fuse type wander-plug.
- 1 Belling-Lee anode connector, or Clix.

Flex, screws, etc. (Peto Scott).



The controls are extremely few in number: only one tuning knob (with concentric trimmer for close adjustments), reaction, on-off and wavechange and the Contra-phase volume-sensitivity adjustment.

What could be simpler? What could be more completely effective and attractive from every point of view?

And the whole set makes up into a pleasing chassis design on most up-to-date lines, as befits the ultra-modernity of the circuit formation.

Anyone can make and operate with success this newest Contra-phase receiver, but it will cost a little more than some of those cheap affairs—cheap in price and cheap in quality!

An Astounding Performance.

You simply cannot expect to be able to build such a set as this for the same cost as a "straight" four of low performance and high H.T. consumption.

The output of the "Contra-phase Four" is on a par with the average A.C. outfit; such a performance was not dreamed of with batteries a year or so ago. And this, mark you, with a current outlay less than that of many normal threes!

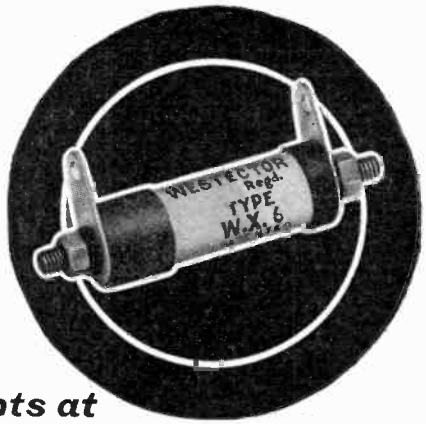
It's a grand set, and one which we are exceedingly proud of, the more so because it has been made possible only by specialised "P.W." developments. The old tag, "Nothing like it anywhere else at any price," is aptly applicable.

There are no components in it which are not readily accessible, for they are all quite standard lines.

(*Continued on page 68.*)

IT'S VERY EASY WIRING

This bird's-eye view of the baseboard shows the relatively simple nature of the wiring. Where a lead goes through to a component underneath the baseboard the hole is numbered to correspond with the number on the under-baseboard diagram which is given on page 68.



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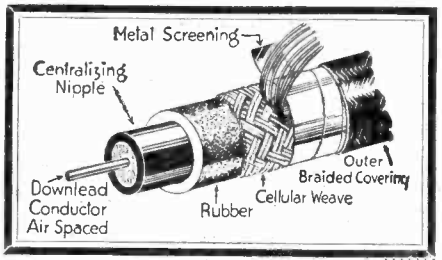

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THE "CONTRA-PHASE 4"

(Continued from page 66.)

But be careful that you purchase the recommended makes and types. This is particularly important in regard to the Class B items, for it should be noted that Class B is rather critical in respect to its associated parts.

If you diverge from the specified components in any way you are diverging from our design, and the results which follow cannot be our responsibility.

Perfectly Simple Construction.

The use of a Metaplex baseboard greatly simplifies the wiring, although, of course, this is not its only purpose.

As the under-baseboard diagram shows it, the baseboard is cut away to accommodate the reaction condenser so that this can be symmetrically placed on the panel.

The positions of the baseboard fixing screws are clearly shown on the panel diagram. The chassis supports each measure 10 in. by 2½ in., and can be of five-ply wood, though, if Metaplex is used also for these, the appearance of the chassis will be improved.

They are fixed to the baseboard by means of screws driven down through this, as illustrated in the wiring diagram.

Those leads which are connected to the Metaplex are all marked "to M.B." Make loops in the ends of the wire and hold these down with small wood screws, supplemented, to make the job better, with washers. Use any spare soldering tags from the components as washers if you are not stocked with ordinary ones.

Certain leads pass through the baseboard. These are numbered so that they can easily be identified in each of the wiring diagrams.

There is ample room for the grid-bias battery on the baseboard, and this can be held in clips which you can buy for a few pence or which you can easily fashion from sheet aluminium or even tin plate.

Now, don't forget that some Class B valves do not need grid bias, and that, if you employ one of these, G.B.2 becomes unnecessary, and that this point on the driver transformer needs to be taken direct to L.T.

Use about twice the normal grid-bias voltage for the driver valve. The exact figure can be found by referring to the valve makers' instructions and noting how much grid bias will be needed to cut the H.T. down to about one-tenth of the normal for the H.T. used.

Setting the Trimmers.

When the Contra-phase control is right over to the minimum position the whole H.F. stage is out of action, so obviously the trimming adjustment should be made with the control moved away from this minimum position. Preferably, adjust it for full volume.

Set the panel trimmer control at about a midway point and then adjust the trimmer on the body of the condenser so that the best possible results are obtained with at least two distant medium-wave stations, one at each end of the dial, and one long-wave station.

As this description is necessarily brief we shall have more to say about this unique receiver next week.

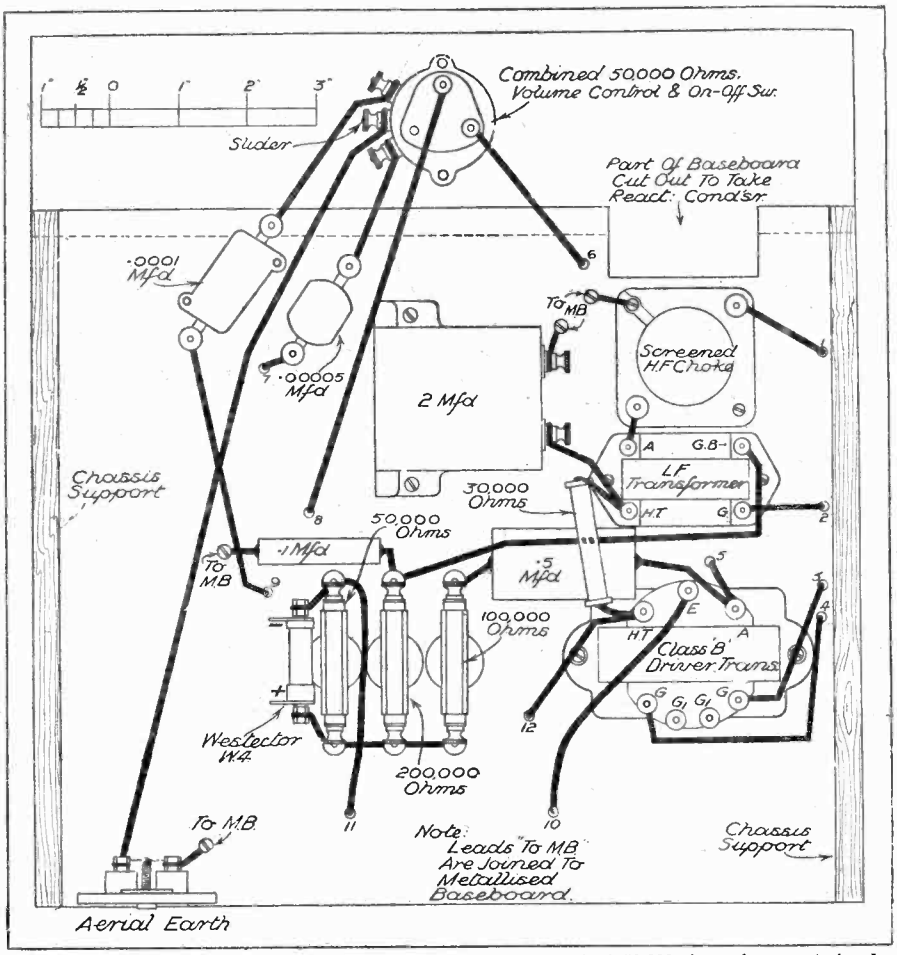
ACCESSORIES

LOUDSPEAKER: W.B., Celestion, Magnavox, Rola, B.T.-H., Epoch, Marconiphone, R. & A., H.M.V.

BATTERIES: H.T. 120 volts.: Siemens, Lissen, Ever Ready, Pertrix, Ediswan, Drydex, Marconiphone, Grosvenor, Hellesens, or Block H.T. accumulators. G.B. 9 volts: Drydex, Siemens, Lissen, Ever Ready, Pertrix, Ediswan, Marconiphone, Grosvenor, Hellesens.

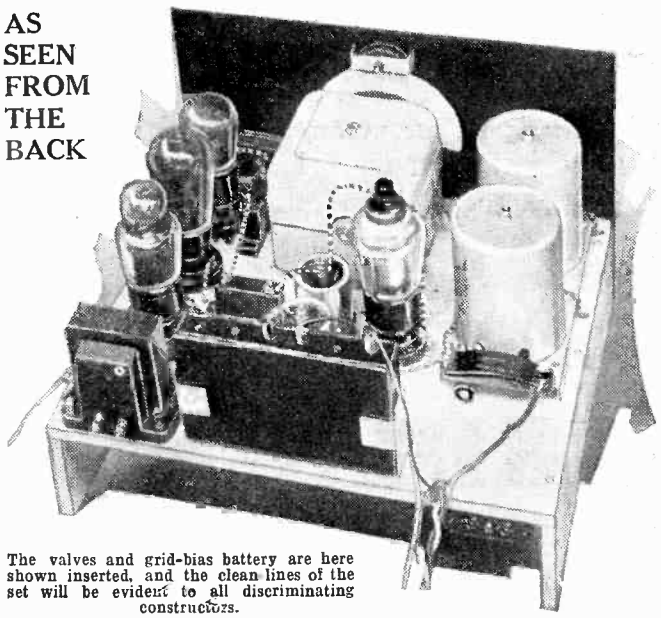
L.T. 2 volts: Block, Lissen, Pertrix, Ediswan, Exide, Oldham, G.E.C.

THE CONTRA-PHASE CONTROL'S CONNECTIONS



At the top of this diagram will be seen the connections to the combined 50,000-ohm volume control and S.G. on-off switch, which is mounted on the panel and effects the "Contra-phasing." This view of the under-baseboard components also shows how a cut is made (top right) to accommodate the reaction condenser.

AS SEEN FROM THE BACK



The valves and grid-bias battery are here shown inserted, and the clean lines of the set will be evident to all discriminating constructors.

ALL ABOUT THE VALVES

Make	S.G.	Detector	Driver	Class B Output
Cossor	220S.G.	210H.F.	220P.A.	—
Mullard	P.M.12A.	P.M.1H.L.	P.M.2A.	—
Mazda	S.G.215	H.L.2	P.220	—
Marconi	S.22	H.L.2	L.P.2	B.21
Osram	S.22	H.L.2	L.P.2	B.21
Hivac	S.G.220	H.210	—	—
Tungsram	S.220	H.R.210	—	—
Dario	TB422	TB282	TB122	—

ABOUT YOUR AERIAL

"How well will your aerial work?" is the question where short waves are concerned, not merely "Will it work?" Here are some helpful suggestions for designing an efficient "pick-up" system.

THE idea seems to be gaining ground nowadays that practically any old aerial will do for short-wave reception. The fact that a few feet of wire strung up indoors will bring in distant broadcast stations has led people to believe that there is no need to use even ordinary common sense in aerial design.

Let me assure readers right away that this is not so. Broadly speaking, practically any *type* of aerial will work satisfactorily on short waves, but any given *type* of aerial can be put up either well or badly.

I have been surprised at the number of hopelessly inefficient aerials that I have come across lately, and the time seems to be opportune to make a few remarks on the subject. Without further preamble let us look into Figs. 1 and 2, which show the same type of aerial erected badly and well.

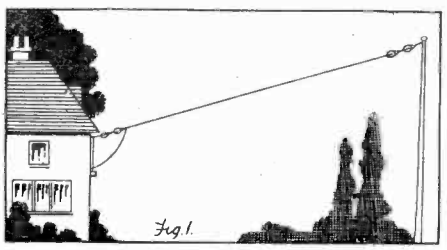
Fig. 1 may be seen in practically any suburban back garden. It is not downright *bad*, but it is capable of much improvement with very little trouble.

To start with, the down lead passes much too close to the gutter; similarly, at the far end of the garden the end of the aerial is too close to the mast. The mast may be of metal or, even if it is a wooden erection, the halyard will probably be of wire, and a vertical length of either kind may easily have a bad effect upon the operation of the aerial.

Variations in Capacity.

As for the gutter, the worst point about that is that the aerial will probably swing in windy weather, and there will be a nice varying capacity between the aerial and earth at that point. The owner will probably remark that such and such a station "swings about terribly sometimes," blissfully unconscious of the fact that his own aerial is doing the damage.

A COMMON ARRANGEMENT



In this particular scheme there is insufficient clearance between the aerial wire and the gutter, a point which may result in inefficiency.

Fig. 2 shows a much better version of the same aerial. I have suggested an improvement that may not be strictly necessary—the increasing of the effective height of the system by attaching the home end to the chimney stack—but the chief differences are, of course, the spacing at the far end and the pulling away of the lead-in from the gutter.

My own aerial is made fast to the roof in a rather similar way, but it did not necessitate the laborious business of climbing about on the roof. I simply tied several yards of light string to a tennis ball and threw it over the house! Provided that the string doesn't catch up among the tiles, there is no difficulty in hauling a wire over the roof and making it fast somewhere in the front of the house.

If there is any difficulty in throwing the ball clear of the roof, simply hold the string a few feet away from the said ball and throw it sling fashion. Incidentally, it is a bit of a work of art to tie string securely to a tennis ball; I found the best way was to tie it across two diameters, like a parcel. Even so, the small boys of the neighbourhood were enriched by one or two balls before the aerial was finally up!

You will note that I have said nothing about the best length, best shape, etc., of your aerial, because, candidly, I don't think it matters so long as the details are right.

A fortnight ago I showed a sketch of a crude indoor "doublet" aerial. Fig. 3 shows a rather better arrangement of the same scheme, which may easily be erected out of doors. I can say definitely that the general interference level is very much lowered by using an arrangement of this kind.

Strictly speaking, a doublet should be designed for one wavelength only, but it works remarkably well over the whole short-wave spectrum, particularly if one tunes the feeders at the bottom end. The two horizontal lengths are equal, and the lead-in is a length of ordinary lighting flex, one end going, of course, to each half of the top section.

It is advisable to keep the feeders at right angles to the top for the first part of their journey, hence the staying arrangement shown.

At the "home" end the feeders are simply connected one to each end of a coil, which is coupled to the grid coil of the receiver. This coil may be centre-tapped, the mid point being connected to earth, but that is not essential. Don't spoil the whole thing by earthing one *end* of it!

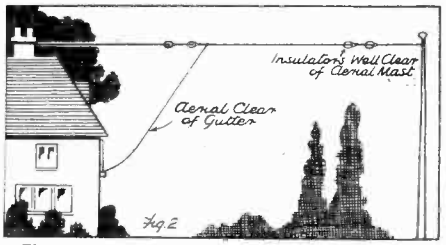
Why Not Try It?

A small variable condenser may be used across the coil, and, if the two halves of the aerial are each about 20 feet, quite good results are obtained on all the short-wave broadcast bands.

I am not quoting this as an extra-efficient aerial for the ordinary man, but as a way out for people troubled with local interference from electric motors, trams, etc.

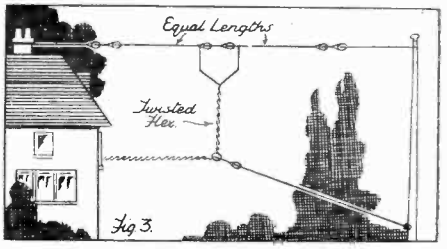
We used to say "a good aerial is worth an extra valve." I rather think that is still correct.

AN IDEAL SCHEME



The scheme illustrated in Fig. 1 would be considerably improved by the alterations indicated here.

AVOIDING INTERFERENCE



When interference is bad, this type of outdoor "doublet" aerial is advisable. Note the arrangement of the "feeder" wires.

(*Continued on next page.*)

On the Short Waves—(*Continued from previous page.*)

I RECEIVE so many letters from readers who ask me to tell them "what I consider the most important point about a short-wave receiver" that I have drawn a diagram which is a sort of compendium of important points.

Observant readers glancing at the sketch will note at least five of them. For the benefit of the less observant I will list them herewith.

Getting Maximum Efficiency.

(1) Grid wiring as short as humanly possible; in the sketch the grid condenser itself forms the lead from the valve holder to the coil—an excellent plan.

(2) The coil is placed in such a position that it is fairly close both to the valve holder and to the tuning condenser, but yet is not crammed up so tightly that inefficiency results.

(3) The tuning condenser is wired *directly* across its coil. I seem to repeat this week after week, but you will hear more of it even yet!

(4) The tuning condenser is not larger than ·00015; and (5) it is equipped with a *good* slow-motion dial.

If ever there were five "secrets of short-wave success," there they are. Just look to your set right now and see how many of these five points might be improved.

* * *

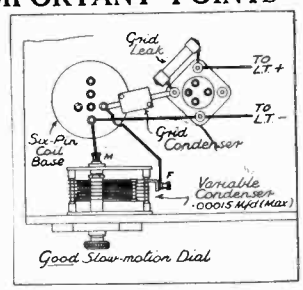
W. S. C. (King's Lynn) suspects me of using a superhet, and wants particulars. Quite wrong, W. S. C. I don't use anything so large and luxurious; but I won't say that I'm not working on one! W. S. C. wants to form a short-wave club in the King's Lynn district. Will anyone interested get into touch with him? His address is W. S. Cornwell, 68, High Street.

FIVE IMPORTANT POINTS

*

This diagram illustrates what our short-wave expert, W. L. S., considers the five most important points in the design of a short-wave receiver. They are enumerated at length in the text.

*



Mr. N. P. Spooner (G 2 N S) has very sportingly offered to lend a helping hand to any short-wave enthusiast in the Bournemouth district who aspires to a transmitting licence. He will coach him in Morse and show him round his own gear. Mr. Spooner, who is an ex-Eastern Telegraph Co. man, is sub-county representative for the R.S.G.B. in that district. His address is 18, Warwick Road, Boscombe. Many thanks, G 2 N S!

J. C. P. (New Brighton) calls attention to two strong harmonics of Radio Normandie (206 metres). They are his fourth on 51·5 metres and his fifth on 41·2 metres. J. C. P.—who is only thirteen, but fairly bursting with enthusiasm—finds W 2 X A D coming over R9 after dark, which, as he says, looks as though conditions might be improving at last.

The "Threshold Howl" Problem.

A. J. L. (Harrow) is sore vexed with our dear old friend "threshold howl," which, by the way, hasn't been mentioned in these pages for quite a long time Let me repeat my previous statement that the best cure of all is to scrap a transformer-coupled stage and substitute resistance-capacity coupling for it.

Threshold howl is definitely tied up in some way with the L.F. transformer, and may be cured by shunting its secondary with a resistance; but this is a beastly business, as it only results in killing off the amplification of that stage. It's more healthy to change right over to R.C., which brings other advantages with it.

V. H. C. (Northfleet) reports that conditions down in Kent seem to be good. He finds the 40-metre amateur band more interesting than the 20, as do most of us these days. "20" is going to be good this summer, though. **W. L. S.**

ROUND the RECORDS

Selections and recommendations from the latest gramophone lists

By K. D. ROGERS.

ALL the music-loving world mourns Sir Edward Elgar. Highbrow and lowbrow are losers by his recent death, while he was still occupied in the composition of a special Symphony for the B.B.C.

An untiring worker, Sir Edward was directing the recording of one of his works as lately as January 22nd last, when he was on what was to prove his death-bed. The piece was the Triumphal March from "Caractacus," played by the London Symphony Orchestra, and is just released by H.M.V.

Made at the great composer's wish, it was personally directed by Elgar through the medium of two telephone lines connecting his bedroom at his home in Worcester with the studios in St. John's Wood.

The recordings were heard by Elgar on a loud-speaker in his room, and his remarks and instructions for further recording were reproduced in the studio on another loudspeaker. The March was recorded again and again until Sir Edward had expressed his approval of the final interpretation. DB2142 is a record that makes musical history—Elgar's last recording, a touching memorial in wax.

Which is the most beautiful melody in the world? An impossible question to answer, as you think of *Londonderry Air, Smilin' Through, Drink to Me Only, Annie Laurie* and many others. The first named is often given the title, and it has probably been recorded more often than any other, either under its usual name or that of *Danny Boy*.

A Best Seller.

Kreisler has just made a record of it (H.M.V.), and so has Alfredo Campoli (Decca), to mention only a couple. Campoli's record I reviewed recently, but Kreisler's is only just released. It should be a best seller—what more praise can I give?

From the sublime to the ridiculous. Whatever you do, if you are a follower of Walt Disney's *Silly Symphonies* on the films, do not miss the Columbia "Disneyesque" record "Crazy Overtures." It is a twelve-inch disc and deals with two well-known overtures, that to *Raymond* and *Poet and Peasant*, in a fashion that can only be described as a musical cartoon. The former overture is, I think, the better of the two, and when I ask you to think of Walt Disney's film characters, and to picture Raymond as a cat, you will begin to see possibilities of a unique recording. Get the record and you will realise how far those possibilities have been realised.

I vouch every ordinary music lover will thoroughly enjoy the record if he has imagination and a sense of humour, though certain humourless highbrows, while not considering the normal Raymond overture as worthy of serious attention, might reckon the "cat" version as extreme musical profanity. I loved it—but then I am only an ordinary sort of person who can laugh.

I have lately had some hard things to say about the much-discussed B.B.C. Dance Orchestra. Now let me hand them a bouquet. Two of their recent Columbia records need special commendation—"Play to Me, Gipsy" (yes, the making of the "hit" is still in progress) and "Unless." With these can also be recommended "Faint Harmony" and "God Bless You," in which the lady vocalist "appears." Get them played over for you at the dealer's and give yourself a treat.

Gracie! The inimitable comedienne par excellence has broken out again in "Keep it in the Family Circle," with which she provides an excellent contrast in "Play to Me, Gipsy." I hear from H.M.V. that Gracie Fields has fled the madding crowd of admirers in England and has bought a villa in Capri, Italy. I hope we shall have no diminution in her record output, for Gracie's recordings are some of the top notes in the gramophone world, in more ways than one.

A voice we do not hear very often nowadays, either on radio or record, is that of "Jetsam"—Malcolm McEachern. But the latest Columbia list has done its best to make up for past neglect in that respect—Jetsam sings two solos on DB1320, and provides, with his accompanist and duettist Flotsam, two more on DB1324.

Excellent Bass Rendering.

The first disc contains "Up From Somerset" and "Devonshire Cream and Cider." They show up McEachern's fine bass voice to its full advantage, and I was pleased to hear how true he was, even on the lowest notes.

"Pipe and Cigarette," on the other record, is a rather messy sort of duet, not attractive musically and not particularly interesting lyrically. I prefer its fellow, "Bats in the Belfry." Both are composed and written by Flotsam and Jetsam.

But with our welcome back to Flotsam and Jetsam we must couple a good-bye. As I write this I hear that, for the time being at any rate, the popular duo act is to come to an end. Flotsam and Jetsam are separating, the former to go on the halls with Olive Groves and George Baker in a new combination, and he of the deep voice to appear in talkies.

At the moment Jetsam is engaged at Shepherd's Bush with Gaumont British, who are doing *Chu Chin Chow*, and I understand Jetsam is really fascinated with his new work and will want to do more of it.

I trust that the old combination will not break up permanently, and that, even if we do not see them on the stage or hear them over the ether, Flotsam and Jetsam will get together and give us some more of their records.

Eight years in one act is a goodly time, but the public are not tired of it, and it is a pity that it should break up, even temporarily.

Mr. Whittington, now on in London, has produced several good numbers, of which "Oceans of Time" is probably the best. Played by Carroll Gibbons and the Savoy Hotel Orpheans on Columbia CB709, it is shown to its best advantage. It is a number that suits this soft-toned, melodious band, and they certainly do it full justice. On the other side is "You're Gonna Lose Your Gal."

At the Dorchester Hotel we find Jack Jackson and his Orchestra, one of the leading bands in the country, and one that can always be relied on to give an interesting rendering of any dance number that is worthy of the name. H.M.V. have recorded "Lullaby in Blue" with this band on B6458, and it is one of the neatest pieces of work I have heard.

It will show up any weakness in your radio-gramophone tonal quality without causing overloading. Muted trumpets are not easy to reproduce accurately, in spite of their quietness. Try this record at home and hear for yourself. The number is good and the playing excellent.

Well Worth Hearing.

On the other side is "Dixie Lee," a hotter recording, but very enjoyable, and again a good receiver test.

Finally, followers of Noel Coward will want Ambrose and his Orchestra playing "I'll Follow my Secret Heart" and "Nevermore," from *Conversation Piece*, on Brunswick 01708. It's a very good recording of these two waltzes, and is worth hearing.

* * *

For the first time in history an album of records, each constituting a little scene from a musical play, have been made and will be released shortly.

Officials of the "His Master's Voice" Company concluded a large gramophone recording contract with the chief artistes of "Conversation Piece" immediately after the first night for them to make an album of records of the principal songs.

Yvonne Printemps, Noel Coward, Heather Thatcher, Moya Nugent, Maidie Andrews, Louis Hayward and the His Majesty's Theatre Orchestra, conducted by Reginald Buston, have been responsible for the records Nos. DA1363-1366.

Each disc constitutes a little scene from the play itself. The listener is acquainted with the action by the words preceding each song, spoken by the artistes in the same way as they do on the stage.

Being Leaves from the Technical Editor's Notebook

LOEWE PAPER CONDENSERS

IN other quarters there is mild controversy around the question "To solder or not to solder?" We found the definite answer to that years ago. Our experience of home-constructor affairs dates back to the days before the B.B.C. came into existence.

And so we are able to state as a fact that many constructors simply will not solder. Give them a set in which there are components without terminals, provide them with the most lucid and detailed description of the process and they will resort to any subterfuge rather than ply the soldering iron. That is, if they build the set at all. Many will not do so.

Even a journal that professes a strong pro-soldering policy failed, in an attempt to obtain support from its readers, to achieve anything like a unanimity of opinion.

Therefore, if soldering is insisted upon as an essential element of the home construction of radio sets, the movement is artificially restricted. That is a strong enough argument against it in all conscience.

And it becomes quite needless to point out the many advantages of "terminalised" wiring.

So I am glad to see that the new Loewe Paper Condensers are equipped with terminals. There are also soldering tags for those to use who want to solder.

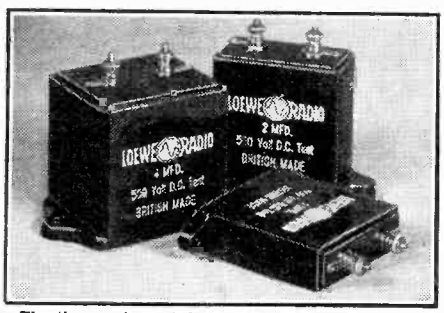
These condensers are, of course, made by the Loewe Radio Co., Ltd., of Fountayne Road, Tottenham, London, N.15.

There are three values available, 1 mfd., 2 mfd. and 4 mfd., at the reasonable prices of 2s., 2s. 6d. and 4s. respectively.

They are designed for a working voltage of 250 volts D.C. and a plus and minus tolerance of 10 per cent. That is to say, they are guaranteed not to vary more than 10 per cent from their capacity ratings.

They are compact in construction and are built into neat bakelite cases having feet for baseboard mounting.

It is said that the condensers are impregnated and sealed with carefully selected waxes under vacuum, in order to eliminate the influences of air and moisture as far as possible and thus ensure high insulation resistances.



The three values of Loewe condenser mentioned in this report are illustrated here. The compact construction and the neat bakelite cases are shown to advantage.

My tests definitely prove that they have these, and that they are in the other ways, too, good condensers that can be fully recommended to the discriminating constructor.

THE BULGIN "SENATOR" TRANSFORMER

Radio has provided more contrasts in one way or another than almost anything else on earth. Take dimensions as an example. It is not so very long ago that it was generally believed that only a big coil could be a good coil. But some of the very best of modern coils are found to be little larger than thimbles when their "cans" are removed.

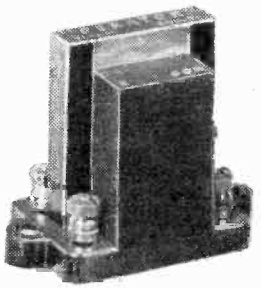
And then, again, do you remember the sizes of some of the earlier L.F. transformers? Compare the sizes of a range of modern transformers. They dwindle from constructions as big as coconuts down to mere matchbox sizes!

And that is no exaggeration at all, for the Bulgin "Senator" L.F. transformer is, if anything, rather smaller than a matchbox.

But we have got used to such extremes, and no one would dream of ignoring it because of its small dimensions. On the contrary, it is recognised that compactness can often be achieved without loss of efficiency. In which event the component in question naturally attains great popularity.

The Bulgin "Senator" L.F. transformer (made by A. F. Bulgin, of Abbey Road, Barking, Essex) is small because it has a nickel-iron alloy core. Nickel-iron alloys possess great permeability, and so a given inductance can be obtained with a relatively small quantity of the alloy, as compared with, say, silicon-iron, and it is also possible to reduce the numbers of turns in the windings.

Actually the primary inductance of the "Senator" reaches the most satisfactory value of approximately 85 henries. Although it is primarily intended for use in parallel-feed circuits, it can be used in the direct connection and still maintain a useful efficiency so long as the current flowing through its primary does not exceed 1 milliampere.



The "Senator" transformer is, in reality, very little larger than this photograph. It is no larger than a matchbox!

The ratio is 1–4, and as I write those figures it is with intense satisfaction that I reflect that, after nearly ten years of effort on my part, this logical manner of placing ratio figures is at last becoming universal.

But I digress. The Bulgin "Senator" is built into an excellently moulded bakelite casing of the familiar Bulgin green colouring, and is from every point of view a well designed and made little component, able to provide a first-class performance.

Its response is, to all intents and purposes, quite straight over the whole band of working audio frequencies. It retails at 6s.

Jottings of Interest to Buyers.

By G. T. KELSEY.

I AM very glad to observe, as a result of a recent survey of the commercial-receiver market, that the battery user is now catered for almost to the same extent as the mains user.

Those of you who have followed my notes for the last twelve months or so will recall that I have repeatedly called attention to the failure of commercial-set manufacturers generally to give adequate attention to the requirements of those without mains, and it is gratifying now to feel that my efforts in this direction have not been in vain.

What pleases me particularly is that those firms who have tackled the question of battery receivers (and there are few these days that haven't) have tackled it well and truly, and some magnificent examples of modern scientific achievement are now available at extremely moderate prices.

Two New Models.

Two of the very latest models to be released bear the Ferranti hall-mark, and they have every appearance of being first-class instruments. Indeed, from my cursory examination of them, I have formed the opinion that they are two of the most ambitious battery designs so far to be produced.

The "Lancastria Battery Consolette," the retail price of which is 14 guineas, is a five-valve superhet with all the very latest refinements, and it is built into a most attractive-looking cabinet. This particular instrument is capable of providing an undistorted output of 2 watts.

The other new Ferranti battery set is

(*Continued on page* 74.)

ERIE CARBON TYPE RESISTORS

Although it is surprising what a lot of trouble can be caused by a quite small fault in a radio set, some outfits seem nearly to fall to pieces before they finally "pack up" altogether.

No doubt you have seen some of those dust-covered, aged specimens that look only fit for the dustbin, but appear to satisfy their owners completely.

They will give only a tithe of the results that they should be giving, but—they work!

And a close examination of such a specimen would, I fancy, reveal an interesting fact, and that is that it was living on its resistances, as it were.

Faults of many kinds can occur which do not actually stop a set working. There can even be broken circuits, but so long as capacity "bridges" will, for instance, enable H.F. energy to get across, the set will go on functioning.

The "bridges" may merely be condenser actions between leads, etc.

But almost invariably resistances have to act as current carriers. And that is why they are in very truth key components, the importance of which cannot be over-rated.

So, above all, constructors ought to exercise the greatest care in the choice of resistances.

Among the makes which I personally have great faith in are the Erie Carbon Type Resistors, made by the Radio Resistor Co., Ltd., of 1, Golden Square, Piccadilly, London, W.1.

It is a long time since I first was able to publish a very favourable report on them in these notes, and my tests of some of the very latest Erie Resistors made prove that the original high standard has been fully maintained.

A representative group of Erie products, the new range of which is fully up to the standard of the earlier models. A wide range of values for all purposes (from 100 ohms to 2 megohms) is available, and constructors can have every confidence in their performance.

I can also add that, although we have from time to time used Erie Resistors for various purposes, we have not yet experienced the slightest trouble with them, and that is, in view of the arduous duties much of our gear has to carry out, by way of being a record in reliability, I believe.

Erie Resistors suitable for use as grid leaks, decoupling resistances and, indeed, for all the usual purposes are available in a wide range of values from 100 ohms to 2 megohms.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

THE NEW WAVELENGTHS FOR THE LONG-WAVE STATIONS

The number of inquiries about the re-shuffle of long wavelengths—recently suggested at a radio conference in Geneva—shows that it is not generally realised that the changes then decided upon do not threaten British listeners with reduced programme facilities.

As a matter of fact, the re-shuffling leaves the relative positions of most of the stations very much as they were.

Daventry, for instance, remains unaffected on 1,500 metres. And it is not expected that this wavelength will be altered when the new "Daventry"—now building at Droitwich—starts testing in a few weeks' time.

Eventually Droitwich will take over the 5 X X programmes completely, and ample notice of this will be given. As high power is to be employed, reception should be greatly improved.

Exactly how the wavelengths of the other long-wavers may be affected is shown in the table below, which gives the old and the new wavelengths side by side.

Name of Station	Old Wavelength	New Wavelength
Kaunas	1,935 metres	1,948 metres
Huizen	1,875 „	1,886 „
Brasov	1,875 „	1,886 „
Lahti	1,796 „	1,807 „
Moscow No. 1	1,714 „	1,724 „
Radio Paris	1,796 „	1,648 „
Deutschlandsender	1,571 „	1,571 „
Daventry	1,500 „	1,500 „
Kalundborg	1,261 „	1,250 „
Leningrad	1,224 „	1,209·6 „
Oslo	1,186 „	1,145 „

No position for Eiffel Tower is given, it will be noted, as it is expected that this station will discontinue its broadcasts.

Radio Luxembourg, too, is unnamed, and although it is not yet certain what that station will do, it is predicted that it will share 1,304 metres with a new Russian station.

For the other stations which now broadcast on long waves four wavelengths have been suggested, and if the scheme is adopted, the following arrangement will come into force:

Name of Station	Old Wavelength	New Wavelength
Minsk	1,442 metres	1,442 metres
Motala	1,357 „	1,389 „
Warsaw	1,415 „	1,339 „
Kharkov	1,345 „	1,293 „

It is hoped that as a result of this scheme the conditions for long-wave reception—notably unsatisfactory since Jan. 15th, when the Lucerne Plan was enforced, will improve until station separation above 1,000 metres is as good as on the medium waves.

FOR GRAMOPHONE-RECORD REPRODUCTION WITH THE "BIFOCAL THREE'."

M. L. W. (Pontefract).—"What I should like to do is to arrange a switch for gramophone reproduction. Preferably one of the S86 type (Bulgin), and necessitating no alteration to the panel, but using instead a long extension rod to project the control over the edge of the baseboard

"It seems to me that the following wiring alterations to the blue-print arrangement would then give the needful change-over—viz., remove wire marked 'EE' from G of valve holder and wire up switch in the following manner:

"G terminal of the V2 valve holder to the centre contact of the radiogram switch. 'Radio' terminal of this to the vacant EE wire (that is, to the terminal of the ·0002 mfd. which is connected to grid leak).

"'Gramo' terminal of switch to one of the new pick-up terminals, arranged like the other terminal pairs at the edge of baseboard. Other pick-up terminal by flex lead to the negative of grid-bias battery (1½ volts in my case).

"With this arrangement all the apparently important leads can be quite short, with the exception of the one from the 'gramo' terminal of switch to the pick-up terminal. Would it be advisable to screen this one?"

The proposed arrangement is quite O.K. As you suppose, the only lead which is in the least likely to need screening is the one from "gramo" to pick-up terminal, and we do not expect you will find that trouble arises if this is left unscreened. If, however, you wish to be sure, use the metal-sheathed type of wire for this and earth the metal covering.

NEW BELGIAN STATIONS.

P. A. (Banstead, Surrey).—"What is all this about Belgium having new broadcasting stations on the air?

"On my set I can get Brussels No. 1 and No. 2 stations (latter speaking French, of course), but apart from this I have not heard any other broadcasting from Belgium. Yet this is what I read in a letter (from an old friend who knows my interest in wireless) received last week from Antwerp:

"'. . . Have you heard Courtrai or any of the eight or nine new broadcasting stations of Belgium on your set?

"'From what I can make out they are not very powerful ones, like the B.B.C's, but, as you always seem to get such good foreign reception, I thought perhaps you may have heard something of them. . . .'

"As a matter of fact, this reference to them in his letter is my first intimation that there are any others besides the Brussels stations, so if you can give me any particulars of wavelength, etc., I shall be pleased to hear."

Apart from the Brussels No. 1 and Brussels No. 2 stations, which, as you know, work respectively on 483·9 metres and 321·9 metres, Belgium now has a number of low-powered stations working on low wavelengths.

They are of but little interest to British listeners on account of the fact that they do not "get over" sufficiently well to this country, partly because of their low power and partly because of their shared wavelengths.

The wavelengths are as follows:

Binche, Chatelineau, Antwerp, Courtrai and Wallonia all work on 201·1 metres, which they share with three other stations, viz., Bordeaux-sud-ouest (France), Nimes (France) and Turku (Finland). The power of the Belgian stations in this group is ·1 kilowatt for each station.

There are six other Belgians working on a wave length of 200 metres, viz., Liége Experimental Radio-Cointe, Wallonia, Seraing, Verviers I and Verviers II.

These also are all ·1-kilowatt stations, and there is another foreign station upon 200 metres as well, namely Pietersaari (Finland). It is thus improbable that any of the Belgians (except, of course, the Brussels stations) have programme value for British listeners.

NO RESULTS, BUT MILLIAMMETER GIVES NORMAL READINGS.

K. B. (Southampton).—"I came up against something the other day which seems to contradict the idea that a milliammeter inserted in the H.T. supply to check the anode current of a set is an infallible indicator of where to find a fault.

"The fault in this case was a nasty one—complete silence, in fact. Yet the loudspeaker was perfectly O.K., and examination of all connections, etc., failed to show up anything wrong.

"To make it worse, there was the milliammeter showing exactly the correct reading for H.T. supply. What would you advise?"

We cannot agree that the milliammeter was not of service, because it indicated, by showing normal anode current flowing, that the valves were getting their voltages correctly, and thus saved wholesale checking of this important part of the equipment.

Apart from the *break* in one of the anode leads, there is always a chance that some important component has become *shorted*, so we should first check over this.

Failing any trace, the next thing would be to ascertain that all grid wiring was intact, with nothing shorted, as obviously this might equally well have the effect of cutting out the programme.

The valves themselves could be presumed to be in order, and consequently a stage-by-stage test would be all that was necessary to show in what part of the set the fault was situated.

(*Continued on next page*)

STATION IDENTIFICATION

TURIN

Every regular listener to the London National programme who uses a sensitive set has noticed, during programme pauses, etc., the song of the nightingale butting in as a kind of background noise. This comes from Turin, who occupies the neighbouring wavelength of 263·2 metres.

* * *

If the dials are readjusted to a wavelength *slightly* higher than that of London National, and reaction is applied, Turin can often be heard very clearly in this country—which is rather remarkable, considering that his power is a mere 7 kilowatts and the distance (from London) is 575 miles.

* * *

The usual announcer is a lady, and the programme is that of the north Italian group, comprising Florence, Genoa, Milan and Trieste, as well as Turin itself.

(The names of the stations are often given in the announcements, the respective pronunciations, in Italian, being: "Fi-ren-ze," "Gen-ova," "Mi-lano," "Tree-estay" and "To-rino.")

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

NO BIAS FOR A CLASS B VALVE.

T. A. (Middlesbrough).—"In the diagram the lead from the transformer is marked 'To Bias for Class B Valve.'

"But the Class B valve I have got must *not* have any bias, the makers say.

"So what do I do with the lead from the transformer? Leave it in the air?"

No. If no bias is required for your Class B valve, the lead in question from the transformer goes direct to the filament circuit, instead of going to this via the G.B. battery.

Take it to the same point as G.B. + goes to—that is to say to the G.B. + terminal itself, or to any other point directly connected to G.B. +, such as L.T. —, H.T. —, or earth.

USING A VALVE SET FOR PHONES AND CRYSTAL RECEPTION.

J. A. (Watford).—"Will you be kind enough to give me the information you gave to a reader last year about using a valve set for phones and crystal reception?

"I cannot find the back number with this in, but I remember the idea clearly. It was telling how to use a pair of phones and crystal detector, when the L.T. battery was on charge, by wiring an extra pair of terminals in the set.

"When the battery was returned all that had to be done was join it up in the ordinary way and undo the phones, which converted the set back to valve reception.

("This is exactly what I want to do for a friend of mine living near here, and I understand that plenty of people in her neighbourhood get excellent results from old crystal sets, so there seems no need for the set to be 'off' for days at a time just because there is no second L.T. battery.")

Almost any sort of valve set can be adapted in this way, especially if it is one using an outdoor aerial, but for good reception it is usually necessary to be situated fairly near to a broadcasting station. This condition is fulfilled at your distance from Brookmans Park, so good results can confidently be expected.

The scheme is to mount a pair of extra "phone" terminals near to the tuning condenser or tuning coil, in an accessible position, so that when the battery has been disconnected for charging and the set is normally useless these extra terminals can be used for phone reception.

If the phones are reasonably sensitive and the aerial normally good you should have clear results from both National and Regional programmes.

Here is the necessary new wiring for the extra pair of terminals, which, as stated, should be accessibly placed, but must be quite near to the tuning coil or condenser.

One of the extra terminals goes to the *moving* vanes terminal of the variable condenser, or to some nearer point which is directly connected to that terminal.

The other new "phones" terminal is then joined by a short lead to one terminal of a crystal detector. The other side of the crystal detector is then joined to the *fixed* vanes of the tuning condenser.

(Or, alternatively, if it is more convenient to wire to the aerial tuning coil than to the tuning condenser, do this, as the effect will be the same because the fixed and moving vanes of the tuning condenser will be found to be joined across the coil in question.)

There is no switching, etc., and no other wiring. So all you have to do when the above modifications have been carried out is to join the pair of phones to the new terminals when the accumulator is away.

This gives you a crystal set in which the tuning is carried out in the ordinary way, but upon the valve set's first condenser.

When the accumulator is back again, simply disconnect the phones, which restores the valve set to its original condition.

A GIFT FOR ALL GARDENERS

A large packet of seeds of the beautiful Orange King Marigold is included FREE this week in every copy of POPULAR GARDENING (now on sale, 2d.). This hardy annual will make a wonderful display in the garden or in vases for indoor decoration.

NO MORE VALVE PINS

Mullard bring out a new type of base.

LEADERS in so many valve designs of the past, Mullard have taken a bold step in the production of their latest range of valves, universal types for A.C. and D.C. They have decided to scrap valve pins and use a system of flat studs which project beyond the side of the base a matter of a few millimetres.

The special holder for the new valves is a cup-like moulding having let into the wall springy clips. The whole base of the valve sinks into the holder, while the studs make contact with the clips all round the circumference of the valve.

Two Types of Mounting.

The grid connections of all the valves, triodes and pentodes alike, are made to the top cap, to which externally connection is made by a spring clip. This separation of the grids from the other electrodes is a very sane proceeding, and one that the Americans have carried out for some time.

The new valves, owing to their lack of pins, obviously are very much shorter than the orthodox types of British valves, and so will be more convenient for use in small universal mains sets and car radio designs.

Two bases are standardised, one of eight contacts for most of the valves and one of five contacts for the small diode valve only. But more of these valves and their characteristics later.

A FINE BOOK ON RADIO

Radio enthusiasts will find the book described below of special value as a work of reference.

A FIFTH edition of the "Handbook of Technical Instruction for Wireless Telegraphists," by H. M. Dowsett, has just been published by Messrs. Iliffe and Sons, Ltd.

The "Dowsett Handbook" is, of course, a standard work and provides a thorough theoretical course; it is used by a large proportion of those desirous of qualifying for the P.M.G.'s certificate.

But in addition it embodies a vast amount of practical information dealing with all aspects of wireless transmission and reception, particularly in regard to marine apparatus. Direction finding, for example, is dealt with in great detail.

There is much new matter in the new edition, including up-to-the-minute details of the latest technique in short-wave marine transmission and reception and constant-frequency oscillators.

There are no less than 525 diagrams and illustrations in this excellent 570-page book, and the text is simple and readable and is broken up into conveniently short sections.

We can very strongly recommend this book to both the experimenter and the professional radio man. It costs 15s.

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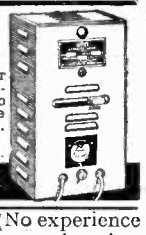
by charging accumulators in your spare time. Complete plant incorporating Westinghouse Rectifiers, to charge 105 cells weekly. **Trade price 4 guineas or 8/- monthly.** Models for A.C. and D.C. mains. *Also Charger for H.T. Accumulators.*



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Send your list of Radio needs for our quotation. Kits, Parts, Sets, etc. Everything in Radio stocked, prompt delivery. 7 days' approval. Catalogue free. Taylex & Standard Wet H.T. replacements stocked.

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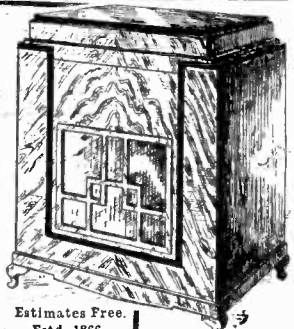

GILBERT Cabinet Maker, **SWINDON** Estimates Free. Estd. 1866.

All applications for Advertising Space in POPULAR WIRELESS should be addressed to the Advertising Department, John Carpenter House, John Carpenter Street, London, E.C.4.

THE LISTENER'S NOTEBOOK

(*Continued from page 58.*)

Way," that Sunday must be something of a red-letter day for lovers of poetry. "Pilgrim's Way," No. 3, was beautifully done. Humbert Wolfe's selection of poems was superb. Janet Taylor, Robert Harris and David Tennant all spoke their lines as they should be spoken, though one did just hope to hear Humbert Wolfe again after the prologue. Unfortunately, we were not favoured. The only fault I could find was in the reading of the 150th Psalm. The two readers who read alternate verses followed one another much too quickly, often at the expense of the last two words of each verse.

* * *

As usual, I followed "As You Like It" from a book. I can recommend this practice, although in an abridged edition one is inclined to lose the place too often. Frankly, this broadcast wasn't the best we've ever had of Shakespeare. But the fault wasn't the B.B.C.'s. It was the play itself, for "As You Like It" lacks the dramatic force of the big tragedies. Nor is the poetry as grand.

All the same, there were great moments in the play. The contemporary music was again supplied by the Dolmetsch family, and this was one of the broadcast's biggest features. This may seem to belittle the contributions of Felix Aylmer and Gwen Ffrangcon-Davies. Their acting was superb. Though a stage presentation of this particular play may have certain advantages over the radio, it is true to say that the singing on this occasion has never been surpassed.

* * *

I heard a new and curious reason for not listening to a certain light musical show the other evening. It was just because the band concerned has a signature tune. Well, if we wash out all the bands that have signature tunes we shall make a number of big holes in our programmes. Broadcasting would be very much poorer, for instance, if Henry Hall faded out for good. I must say I can't understand this aversion to a signature tune, but my informant was quite adamant about this, though he couldn't state anything more definite than that it branded the band as an inferior one.

C.B.

THE B.B.C. INVESTIGATED

(*Continued from page 55.*)

proportion of licence revenue it appropriates. If the B.B.C. were really active and serious about this there would be lots of outside support forthcoming, especially if the B.B.C. would agree to curtail its publishing activities. It is all wrong that the B.B.C., through using the advertising power of the microphone, should take rather more than £500,000 a year of advertising from a none too prosperous publishing industry. Let the B.B.C. stick to the job of broadcasting and insist on getting the money to which it is entitled on that account.

As to personalities, we have seen how Sir John Reith is still the controlling spirit. There are periodical rumours of Sir John leaving the B.B.C. to take up a big job elsewhere. First it was the Electricity Commission. Then it was the American Ambassadorship. Then the Vice-Royalty of India. Now it is a Cabinet post, with a seat in the House of Lords. The Ministry of Pensions is mentioned. Another rumour is that Sir John will go straight into parliamentary politics, standing for the House and assuming the leadership of a new party on "business" lines.

My view is that Sir John will stay where he is—at least until the end of 1936. At the end of the licence and Charter he is practically certain to get another honour. As to who will succeed him, if and when he hands over the B.B.C., it is obviously too early to say.

Sir John's Successor.

Col. Dawnay has been "tipped" as a Government nominee for the job. And the fact that he left the Imperial General Staff when he was within sight of getting to the top suggests that he may have expectations of the succession at Broadcasting House. My own view is that Sir John Reith will be followed by someone whose name has not yet been mentioned for the job.

Sir Charles Carpendale, the Administration Controller, reaches the retiring age of sixty this year, and it is not known yet whether he will accept the invitation of the Board of Governors to stay on for another year. If the job of Administration Controller is maintained it may be given to either Commander Goldsmith or Major Nicolls, who are now neck and neck for the preferment.

THE LINK BETWEEN

(*Continued from page 71.*)

the "Lancastria Portable Consolette," and the price of this model is 15 guineas. It is similar in many respects to the cheaper model, but incorporates an extra valve, and the particularly attractive cabinet is provided with a ball-bearing turntable.

Full details of these sets, as well as of all the other famous instruments in the Ferranti range, are given in a catalogue which is available under our postcard literature scheme. **(No. 79.)**

Those Conversion Leaflets.

Having just dug my way out of a deluge of postcards (phew!), may I crave your indulgence—if yours happens to be among them—for any slight delays which may occur in the dispatch of Varley "Bifocal" conversion leaflets? This morning, as I write these notes, it is very much a case of postcards to right of me, postcards to left of me, and even, I am afraid, postcards on top of me.

Well, well, it only goes to prove what I have felt all along. Focused radio has definitely caught on, and there is little doubt that the interest—already phenomenal—will be even greater.

For the benefit of readers who are requiring copies of this interesting leaflet, may I remind you that all applications under our postcard scheme are dealt with in strict rotation, and that, in these circumstances, if you have not already sent in your application you would be well advised to do so without delay?

All you need to do is to put a large number "78a" on a postcard, together with your name and address (in block capitals, please), and address it to me at Tallis House, Tallis Street, London, E.C.4. Full conversion details will then be sent to you free and post free.

A New Cossor "Melody Maker."

The name of Cossor's famous kit set for home constructors will require no introduction to our readers. For years it has held an esteemed place in the realm of home construction, and now I am delighted to learn that still another model—the "340"—has been introduced.

Next week I am going to endeavour to give you full details of this very latest model. Meanwhile, I will just add that it is intended for battery operation.

OUR POSTCARD SERVICE

Application for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way — just quote the number or numbers.

INCREASE THE SELECTIVITY OF YOUR SET!

2/- WITH HANDY HOLDER . . . 2/6

OVER 1,500,000 LISTENERS USE A—— to separate those stations that overlap each other. Get rid of that annoying muzziness that spoils local reception. Just **FIX A PIX** in your aerial lead. You will be surprised how sharply your set tunes, and delighted at the number of new stations you can hear clearly. Try one to-day. Send us 2/-. If you are not completely satisfied, return it to us within 7 days for full refund.

BRITISH PIX CO., Ltd., LONDON, S.E.1.

PIX

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

Trouble with a Radiogram.

I HAD an experience with a radiogram recently which seemed very puzzling at first. This radiogram was used for only a few minutes at a time, and had been working in this way for a long period quite satisfactorily. Later on it began to be used more extensively, and it was then that the trouble showed up.

I found that the rectifier in the unit which supplied the field current to the moving-coil speaker was getting very hot, and matters went from bad to worse until eventually it was hardly possible to switch on the radiogram without blowing the fuses—I mean the fuses inside the radiogram, of course, not the mains fuses.

The unit in question was taken out and opened up, and it was then seen that the rectifier had tiny metal beads all over the discs, showing clearly that it had been very hot and that the soft white metal had melted out.

The "Moving-Coil" Rectifier.

In order to make sure that this was really the cause of the trouble a separate high-tension mains unit was brought into use, and leads from this were run to the field of the moving-coil speaker. Incidentally, I wanted to know the value of the resistance in series with the speaker field, and this was found approximately by the very simple process of connecting a three-volt battery to it in series with a milliammeter. The milliammeter, which was a fairly accurate one, showed 3 milliamps, giving a rough idea of the resistance in series with the field, about 1,000 ohms.

With this separate H.T. unit everything worked all right, showing that the original mains unit was definitely at fault.

The problem then was to decide why the rectifier should go wrong, since, as you know, these Westinghouse metal rectifiers are usually exceedingly reliable. In point of fact, I have known them subjected to all sorts of abuse and to stand up to it in the most remarkable way.

A Case of Shorting.

However, in the present case I found that the resistance in series with the field was probably touching the metal base of the case and shorting. There was another place where one of the leads to the rectifier looked as though it might have been shorting also. I do not know which of these it was, but certainly there was every evidence that shorting had been taking place and that the poor old rectifier had been very heavily overloaded.

At first I suspected a couple of smoothing condensers which were across the output leads of the unit, but strangely enough these proved to be quite all right. At any rate, when a new rectifier was put in and care taken to insulate the series resistance properly, everything worked quite O.K. and there was no perceptible heating of the rectifier whatever.

Due to a Condenser Breakdown.

Another trouble which I had with the same radiogram, although not on the same occasion, was with the high-tension supply unit, which, of course, is entirely separate from the unit which supplies the field of the speaker. In this case also the rectifier showed signs of heating, although not to any very serious extent. After testing all the various tappings, I came to the conclusion that one of the condensers was causing the trouble, and so made a separate test of each of the condensers. The particular ones which came under suspicion were in a 16-microfarad block of four condensers.

Eventually the source of the trouble was traced to one of these condensers in the block having broken down. Accordingly, the leads were simply disconnected from the terminals of this particular section of the block and separate leads were run out to another 4-microfarad condenser, which incidentally could not be connected within the metal case of the mains unit and had to be placed outside. When this was done everything worked perfectly, and the rectifier ceased to warm up any more.

I mention all this because it is quite likely that some of my readers may have the same sort of experience at one time or another, and it is just as well to know

(*Continued on next page.*)

YOU CAN TAKE IT FROM ME!

ELECTRADIX

BARGAIN SALE LIST Will Save You Pounds

ELECTRADIX "P.W." 11 TABLE RADIO MIKE should be with every Wireless Set. Be your own announcer. A bakelite production containing the high-ratio transformer. Fitted battery plug switch and output terminals. The excellent results and low price have made this one of our most popular models. Only **10/6**

MICROPHONE BUTTONS are wonderfully interesting for experiments with Phones. **1/-**

The BATTERY SUPERSEDER makes H.T. from your L.T.2-volt battery, rectified and smoothed. Gives 3 tappings and lasts indefinitely. A boon to those who are not on the mains. **Reduced from £3/15/-. New and Guaranteed 37/6.**

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Transformers and Headphones, 4/-, Eliminators, Mains Transformers and Moving Coils quoted for. 24-Hour Service. **Trade Discount.** *Clerkenwell* 9069.
E. MASON, 44, EAST ROAD (nr. Old Street Tube Station), LONDON, N.1.

4 YEARS USE—only twice recharged — PERMANENT H.T.

Install the wonderful Standard Wet Battery, and, as thousands of others, end H.T. troubles for good. O. L. W., of Lewisham, writes, **"I bought the battery nearly 4 years ago and this is only second time I have had to recharge; am well satisfied with low cost and dead silent power."** Why put up with dry battery replacements and poor results when running down? The Standard gives abundant power, pure tone, lasts years. Periodical replenishment all that is necessary. **120-v. 12,500 m.a. £2 complete, carr. paid.** Write for details. **ALL STANDARD BATTERY SPARES SUPPLIED.—The Wet H.T. Battery Co. (P.W.), 26, Lisle Street, London, W.C.2.** Gerrard 6121.

Any voltage supplied.

The Paper for the Boy of To-day!

MODERN BOY

Every Saturday - - - **2d.**

TECHNICAL NOTES

(Continued from previous page.)

what to look for. It was rather curious that both these particular troubles should have arisen, as there was probably no connection whatever between them.

Puzzle : Find the Motor.

Talking about radiograms, I was listening to one in a friend's house the other day; he had not had it very long and was displaying it with the usual pride of the new owner. On switching on the radio, however, this was accompanied by the most appalling crackling, which had a rhythmical sound about it, very suggestive of a motor, but the crackling was so bad that I started to look about for bad contacts or broken leads.

At any rate, after a few minutes of this it suddenly dawned on me that the best place to look for a motor was in the gramophone part of the cabinet, and on lifting the lid there, sure enough, was the cause of the trouble. The gramophone motor had been left switched on whilst the radio was working, and all the crackling we were picking up was from the motor, which was of the commutator type. On switching off the motor everything was quite all right, and the radio part of the set worked perfectly. My friend heaved a sigh of relief at finding that this beautiful radiogram was really quite in order, and everybody wondered why everybody else had not had the sense to look under the lid!

This sounds very silly, I know, but since mentioning it to one or two other people I have been told that it is a thing that has many a time happened before. Probably some of you have had precisely the same experience, which only goes to show how you can look for the cause of trouble in distant places when, in point of fact, it is under your nose all the time.

A Curious Fault.

While I am on this subject I may as well take the opportunity of mentioning another rather curious thing which cropped up the other day. I was listening to a record, and the reproduction was "rattly" or "reedy," the owner of the set explaining that it was due to a fault in the diaphragm of the moving-coil speaker. It sounded to me, however, like something wrong with the pick-up or indeed with the needle itself; it gave me the impression that the needle was not properly tightened up in the needle holder.

On examining the pick-up I found that the needle could not be pushed very far into the holder, with the consequence that it was a bit wobbly, and, of course, this was more so with a fine needle than with a thick one. I decided that it was worth while to have the pick-up off and look at it, and, in doing so, it dawned on me that probably there was a piece of broken needle up at the top end of the holder. Sure enough, when we got the pick-up under the light and used a pin for probing down the holder we found that there was some loose object at the bottom.

Cutting Out Mush.

Noises in a set come from a great variety of causes, and different remedies must be sought accordingly. But "mush," as it is vaguely called, can often be cut down by means of a high-note filter, cutting off frequencies above, say, 5,000 cycles. This will probably be found a very useful adjunct, especially to a very sensitive set which is being used near its highest sensitivity.

If you adjust the filter to cut off somewhat lower frequencies, say down to 4,000 or 3,000 cycles, you will almost certainly begin to notice a preponderance of bass: actually it is only an aural illusion, due to the absence of the high notes and the *relative* strength of the bass.

Noise v. Signal.

When you are listening to a local or powerful station, however, where the ratio of signal to noise or mush is much higher, you may not need the filter, and so it is useful to have a switch to cut it out when not required. It is no easy matter to design a set that will bring in very strong and very weak stations indiscriminately—perhaps I should say equally efficiently—and therefore a filter which can be put easily in or out of circuit is very useful for equalising things. Such a device is included in a good many commercial sets on the market.

NEXT WEEK

TWO FINE FEATURES:—

A NOVEL PICK-UP ADAPTOR

AND

PRACTICAL HINTS FOR D.C. MAINS USERS

Recent Television Developments.

An interesting and probably important development is being made in connection with television. I expect you know that the television of a film is much less difficult than the television of a direct subject, especially an outdoor scene. Consequently there has been a tendency of late to concentrate upon the televising of *films* of events rather than upon the *actual* events at the time of happening.

This, of course, is not television as ordinarily understood, but clearly the shorter the "delay" between the event and the transmission the more nearly the system corresponds to true television. With this idea in mind some German inventors have now developed a system in which a film of the event is taken by film camera in the ordinary way, the film, however, passing straight on into developing and fixing tanks, and then before the television transmitter.

The actual "delay" is only 10 seconds, and the film is televised whilst still wet. As it is a negative it is "reversed" in the process of transmission by a simple electrical device.

"PRACTICAL KNOWLEDGE FOR ALL" TOKEN 5

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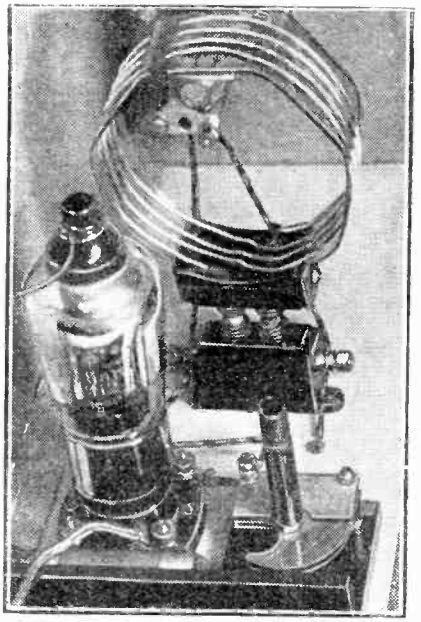

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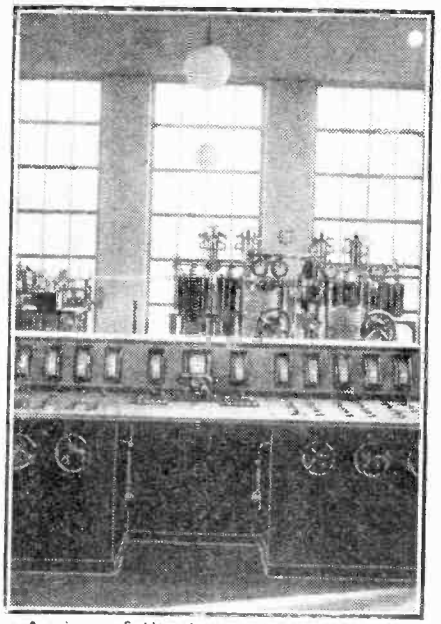

A view of the transmitter room at Bisamberg.

OTHER ITEMS INCLUDE:

How to Obtain Better Radio

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B.B.C. News

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Some Novel Television Ideas

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Topical Tips

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From My Armchair By S.T. etc., etc., etc.

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"BIG POWER AT BISAMBERG"
Details of the high-powered Austrian Broadcaster

AND

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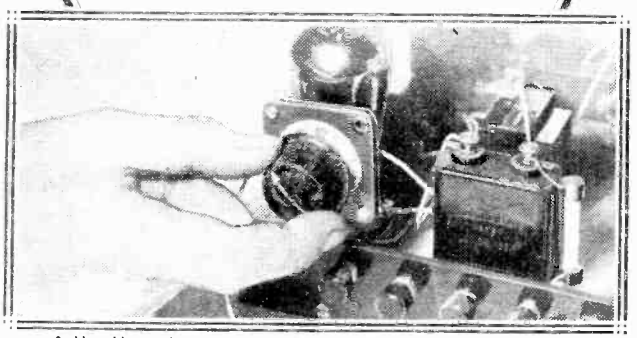
A dual-capacity receiver for short-wave reception.



Adjusting the tone control on the "S.T.300 Star."

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The New Power Valves

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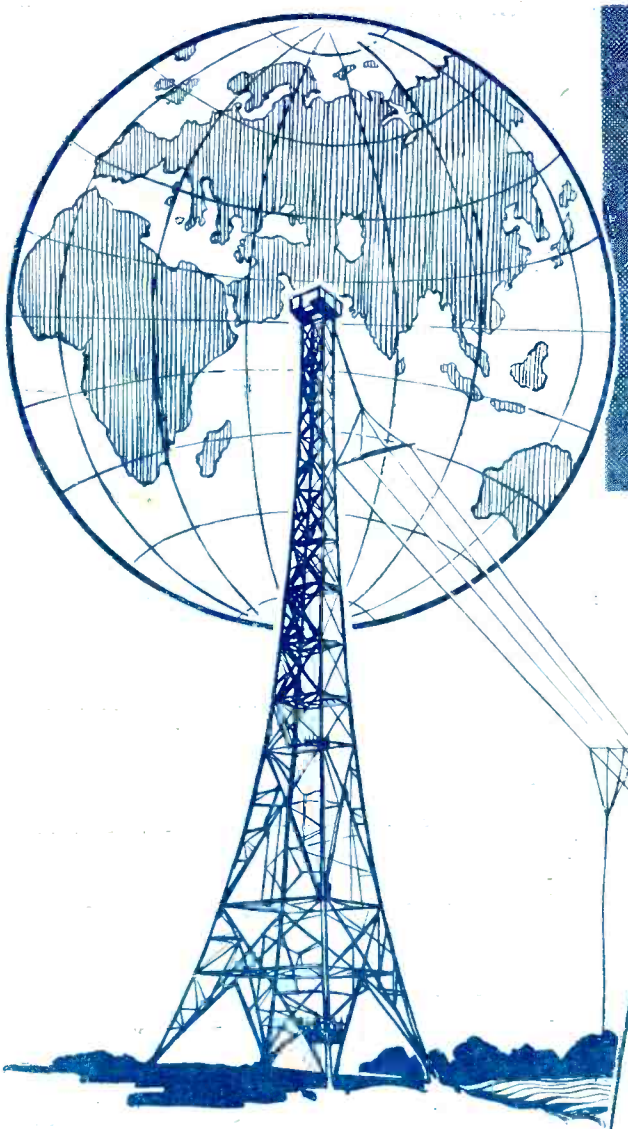

Invaluable STATION Information

On Sale at all Newsagents and Bookstalls.

EVERY owner of a wireless set, whether he be ardent experimenter or ordinary listener, must have a copy of this handy 24-page atlas and guide book. It helps you to tune in to any station to which you wish to listen, and it can be kept beside your set as a permanent record of your own dial readings.

There are many pages of beautifully-printed maps, showing clearly at a glance just where all these "foreigners" are, and there is a complete alphabetical list of all the principal stations with their new wavelengths as allotted by the Lucerne Wavelength Conference.